SCIENTIFIC AMERICAN

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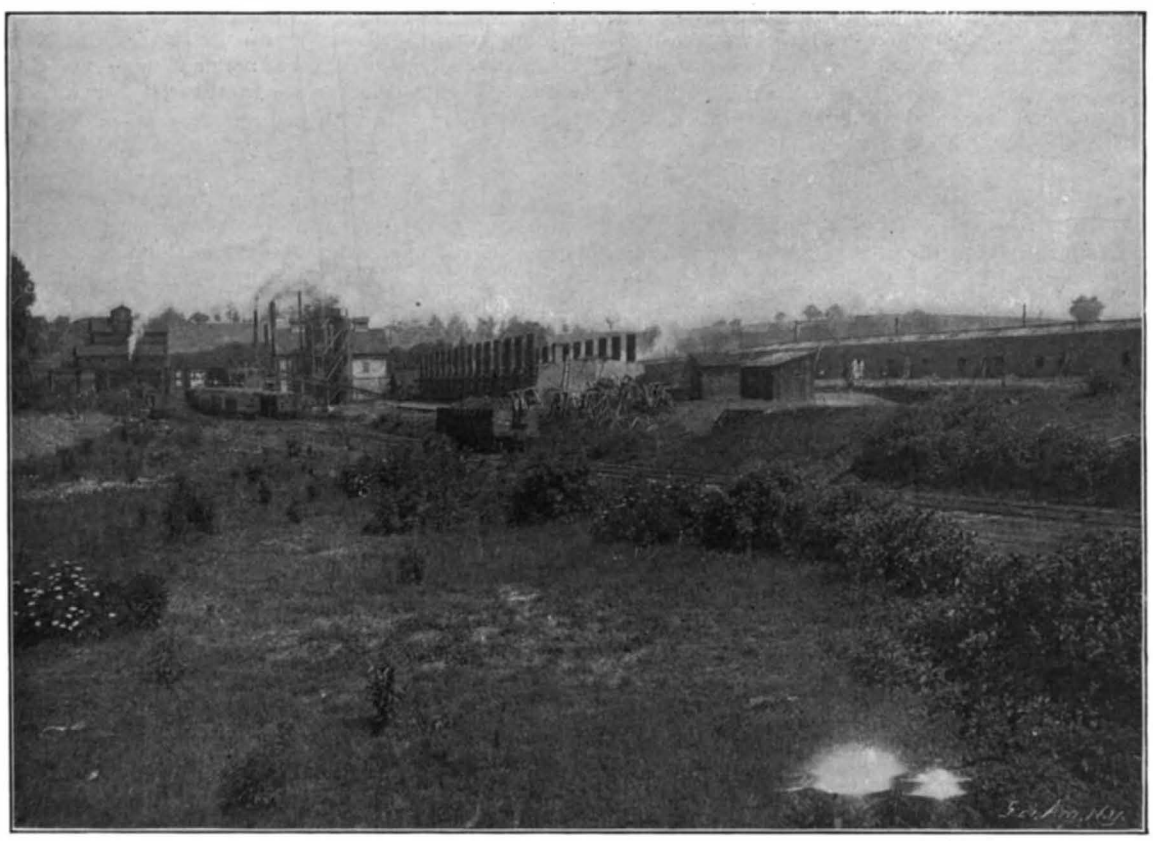
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXXV.—No. 6. ESTABLISHED 1845. | NEW YORK, AUGUST 10, 1901. | $3.00 A YEAR. 8 CENTS A COPY.

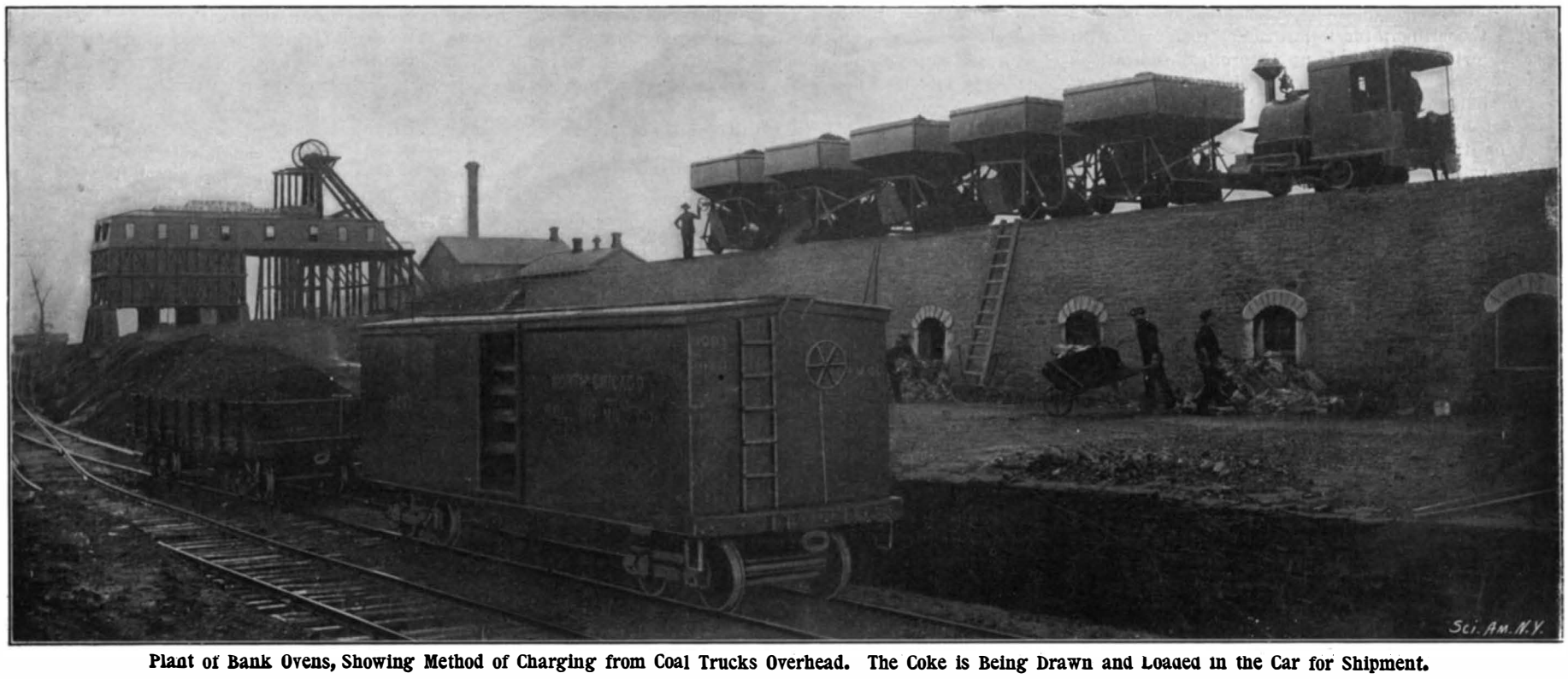
Coke Crusher—Capacity, 2,000 Tons per Day.

Charging, Drawing, and Loading Coke.



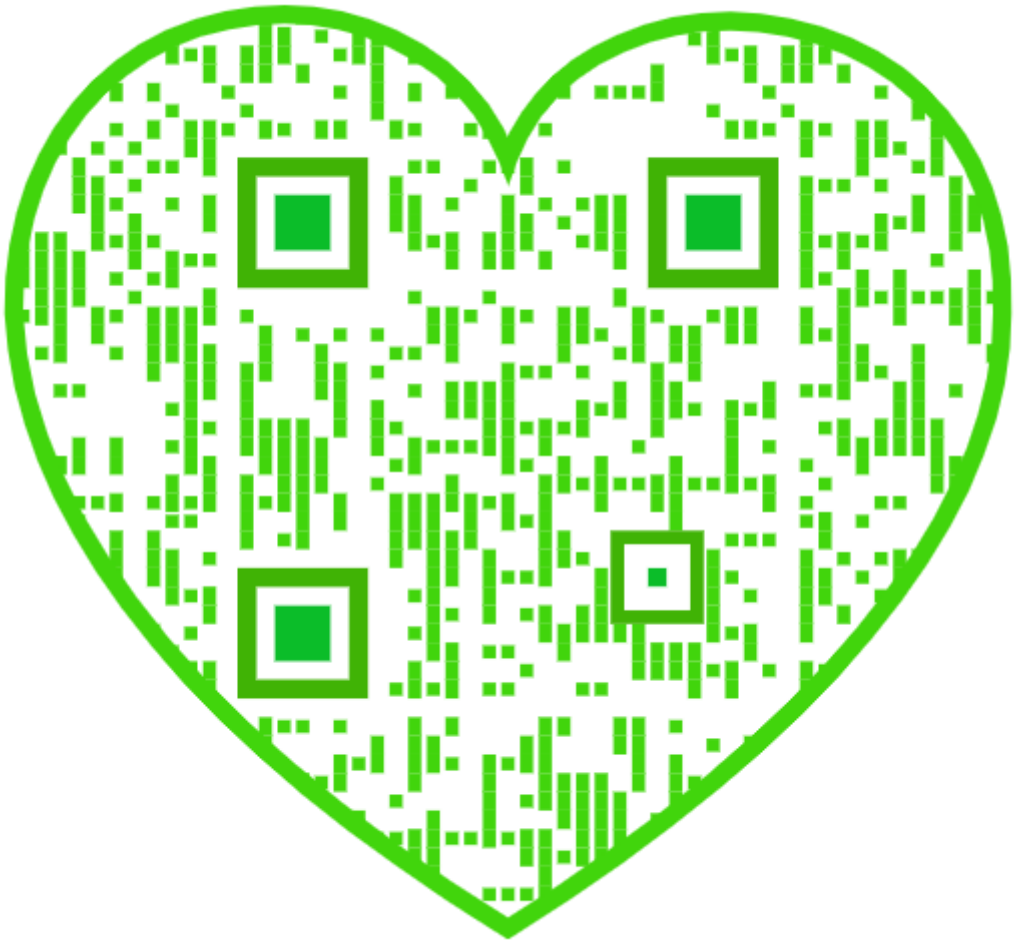
Plant of Thirty, Beehive, By-Product Coke Ovens.

Partly Coked Contents of a Coke Oven.



Plant of Bank Ovens, Showing Method of Charging from Coal Trucks Overhead. The Coke is Being Drawn and Loaded in the Car for Shipment.

COKE MAKING IN THE CONNELLSVILLE REGION.—[See page 86.]



Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, AUGUST 10, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

SUPERVISION AND SAFETY OF THE BROOKLYN BRIDGE.

There are some engineering and architectural works which, if correctly designed and properly constructed, are safe for all time; there are others whose safety is directly proportional to the intelligence and care of the men (engineers or mechanics) appointed to supervise and keep them in repair. Prominent among the latter class of structures is the modern steel bridge, and particularly that type of it known as the stiffened suspension bridge, to which type the Brooklyn Bridge belongs. In the case of the great East River crossing, there are peculiarities in certain parts of the design and construction which demand a thorough knowledge of the theory of bridge construction on the part of its caretakers; for it is only a qualified engineer who would perceive just which are the points most liable to failure, and therefore calling for particularly close inspection. Such critical parts existed in the bridge from the very first, being inherent, as we have said, in the design; and their liability to overstrain has been greatly aggravated by the fact that, from the time construction was begun, various increments in the live loads have been allowed, until now much of the structural material of the bridge is being strained beyond the unit recognized as good practice by modern engineers, and some of it—as recent events have shown—beyond the breaking strength.

That actual breakage should have occurred, is to be attributed to lack of knowledge, or lack of care, or both. We are free to confess that recent utterances of the engineers in charge seem to indicate that they are not as familiar with the theoretical and practical aspects of the problem which is presented by the care and upkeep of this costly and overworked bridge, as the importance of the structure demands. For proof of this it is not necessary to go beyond the Chief Engineer's own report, in which he makes the astounding admission that the break in the suspender rods could not be detected until the broken ends were pulled up to view by the rising of the cable; while his assistant has asserted that the broken rods were sheared off by coming in contact with the upper edges of the floorbeam chords. What makes the Chief Engineer's statement the more disquieting is his admission that there had been previous breakages at this point of the bridge; for it is evident that even with practical evidence to back up theoretical indications of weakness, the bridge authorities either did not know how, or did not care, to use that simple method of inspection by a tap of the hammer, which is practised to-day on the tie-rods of every Howe truss on our Western railroads.

As a matter of fact, the whole atmosphere in and around the Engineer's office of the Brooklyn Bridge is particularly disquieting in view of the recent critical condition of the structure. There seems to have been too much of the "happy-go-lucky" about the management. Plans of parts seem to be difficult to find, and in some instances do not appear to exist. Is there on file in the Engineer's office a complete strain-sheet of the bridge under its present loading, showing the maximum stresses upon every member under the most unfavorable conditions of temperature and loading? Does this sheet show the actual tension in the outermost, diagonal over-floor stays, at maximum temperature and under maximum local concentration of load? When the trolleys were admitted upon the roadways, was any calculation made of the *dynamical* effect of the motor axles as they pound across the gap at the center of the main span? What is the tensional strain, under this hammering, at the center of the pair of channels which form the bottom chord of the floorbeams at this point? When the incident of the nine broken suspenders occurred, what was the increase of load thrown upon the suspenders, adjacent to the gap, which did not break? And what was the margin of resistance in these suspenders by which the process of snapping was prevented from running the full length of the truss and dropping the northern roadway into the river?

The Roeblings built a bridge which embodied the best engineering knowledge of twenty years ago, at a period when the theory and practice of bridge building, as we now know it, was not far removed from its infancy. In spite of its added loads the bridge is not an unsafe structure to-day—always provided (again we emphasize this point) that it is supervised by professional men who see to it that a most thorough system of inspection is unceasingly maintained.

THE NEW YORK CENTRAL RAILROAD TUNNEL NUISANCE.

On another page will be found the report of the grand jury's investigation of the two-mile tunnel, by which the New York Central Railroad reaches its terminal at Forty-second Street. We most heartily concur in the three recommendations of the grand jury, namely, that the wall dividing the two outer tunnels from the center tunnel be removed; that passenger coaches be protected from the sun when not in use; and that some other motive power than steam locomotives be used through the tunnel. The management of the New York Central road have only themselves to thank that this great public nuisance should have become the subject of action by the grand jury. Had the company shown the slightest indication of that anxiety to consider the comfort of their traveling patrons which, in recent press interviews, the leading officials of the road have claimed to experience, the present action of the grand jury, which is certainly not very creditable to this great and wealthy corporation, would never have been taken.

The discomfort due to heat and noxious gases is greatest in the side-tunnels, and the remedy suggested of cutting away the dividing walls and substituting for them steel columns and girders, would afford a very marked relief, by permitting the heat and gases to escape through the open wells which exist above the inside express tracks. If the company has a fraction of that solicitude for the public comfort of which they recently have made such loud protestations, the recommendation that during the hot weather passenger trains, when not in use, should be stored in sheds, to prevent their being heated by the rays of the sun, will meet with an instant response. As to the change of motive power, that also has to come; and it will be as well for the New York Central Company to realize at once that the public is determined that it shall come, and with as little delay as possible. The officials of the road have recently stated that they have been expending unlimited time and thought upon this problem, and regret to find that all of the alternative plans present insuperable difficulties, etc., etc. As a matter of fact, the public is beginning to realize that the most insuperable obstacle is the very large expense to which the company will be put by this alteration of its tunnels and this change of motive power. For the officials of the road to say that a change of motive power is mechanically impossible, is to trifle both with the subject and with the hundreds of thousands of passengers who are put to unnecessary discomfort and suffering by the present conditions. If the railroad company had the disposition to make the change, we venture to say that the electrical companies who are now equipping the Manhattan Elevated Railways would be perfectly willing to draw up a feasible scheme and put in bids for equipping the line from Mott Haven with the third-rail system, and providing the thirty or forty electrical locomotives necessary to bring the trains through the tunnel and handle them in the terminal yard. It is true, a third rail would involve some very complicated work at the numerous crossings and switches in the yard; but there is no reason to believe that these difficulties are beyond the ability of a good electrical engineer. The only objection to such an installation would be the three or four minutes delay in changing from steam to electric locomotive at Mott Haven. But this would be offset, as far as the operation of the road is concerned, by the convenience of having the steam locomotives disengaged at the round house, and saved from the round trip into and out of the terminal yard at Forty-second Street.

There can be no mistaking the genuineness of this last outburst of indignation against a railroad company of which the public has been such a liberal patron, and to which the city of New York has extended in the past such liberal concessions. We should have thought that with the construction of the Hudson River Bridge and the entrance of competing roads into Manhattan Island a probability, the New York Central would have been prompted by mere instincts of self-protection to remove a nuisance which is a standing disgrace to an otherwise admirable system.

DIVERGENT OPINIONS ON BATTLESHIP DESIGN.

Broadly speaking, and without the least disparagement of the ability and good judgment of the gentlemen composing the minority in the Naval Board on Construction, it must be admitted that there is what we might call an *a priori* presumption in favor of the superior excellence of the new type of battleship recommended to the Department, based on the significant fact that the three technical members of the Board are united in favor of the majority design. Rear Admiral Bowles is expertly qualified on the question of the structural arrangement of the hull and disposition of the armor; Rear Admiral Melville is similarly qualified to determine questions of motive power, coal supply, etc., while Rear Admiral O'Neil, by virtue of his office, is entitled to be called the most qualified expert on questions of armament. Regarding the merits of the two designs, as shown elsewhere in our issue, it is admitted that each has virtues which so strongly recommend it, as to prevent any offhand decision as to which is the all-round better ship. The Bradford design, with its four 12-inch, twelve 8-inch and twelve 6-inch guns, is in respect of its offensive qualities an enormously powerful vessel, and on paper it stands far ahead of any of the vessels built or building for any navy in the world. We presume that the Admiral has fully worked out the details of weights, displacement, coal endurance, etc., for this ship; but we are free to confess that even with her 17,200 tons displacement, she looks scarcely able to carry such an enormous battery with the great weight of emplacements, ammunition hoists, and ammunition, necessary to adequately mount and serve it, and at the same time find room for engines that will drive her at 19 knots, and for the large supply of coal which she must carry to bring her up to modern requirements as to sea speed and radius of action. An undue proportionment of weight to guns and armor must be accompanied by a reduction in the weights allotted to other essential elements of the ship; and the mounting of twelve 8-inch guns and the six heavy turrets in which they are installed, cannot have been accomplished, we fear, in this design without some sacrifice in other directions. We say this with due appreciation of the fact that 300 tons of extra displacement is allotted to cover these weights.

The Bowles design is marked by great simplicity and by the total elimination of one caliber of gun, reducing the number carried to three, namely, 12-inch, 7-inch, and 3-inch, as against the four sizes, 12-inch, 8-inch, 6-inch, and 3-inch, carried in the Bradford design. While it is true, as urged by Admiral Bradford in his minority report, that the Bowles design introduces yet another altogether new type of ship into the navy, we take it that it is the expectation of Admiral Bowles that the type, if adopted, will be so satisfactory that it will remain, with possible modifications, a permanent type for future ships. As regards the new 7-inch guns which it is proposed to use we consider that developments in guns and armor during the past few years point to this caliber, or perhaps, preferably, a caliber of 7½ inches, as the most desirable for what we might call the intermediate battery of battleships. The commonly accepted practice in our navy has been to install four heavy guns for penetrating the main turrets and the armor belt of an enemy; an equal or larger number of 8-inch guns for use against the lighter armor of the casemates and smaller turrets; a secondary battery of 6-inch guns, also for use against the lighter armor of the ship, and a large number of 14-pounders and 6-pounders for the purpose of attacking the unprotected portions of the ship with a storm of smaller shells. The wonderful improvement in armor, however, due to the introduction of the Krupp process, has discounted the efficiency of all guns, great and small. The 6-inch gun is no longer able to penetrate 6-inch armor at ordinary fighting ranges, nor is the 8-inch gun serviceable against the heavier belt and turret armor. At the same time the 8-inch is over-heavy for use against the more lightly armored portions of a vessel—facts which would indicate that the time has come for the introduction of a weapon of intermediate caliber, such as 7 or 7½-inch—one that would combine some of the penetrative power of the 8-inch with the rapidity of fire, light weight, and handiness of the 6-inch gun.

We have noticed in the development of foreign naval ordnance during the past year or two indications of the recognition of this necessity. The French seem disposed to throw out the 5.5 rapid-fire in favor of the 6.4 and 7.6 semi-rapid-fire gun; while England has been building a 7.5 rapid-fire gun which has already made its appearance in one of her later battleship designs. As modified by the recent extraordinary improvements in armor, we think that the desiderata in the arming of a battleship are as follows: A main battery of four heavy guns for attacking the water-line belt and main turrets; an intermediate battery of 7-inch or 7½-inch rapid-fire guns for attack on casemates and the more lightly armored turrets of the

enemy's intermediate battery; and thirdly, a numerous battery of 3-inch, 12- or 14-pounder guns, whose province it would be to smother the enemy with a storm of projectiles, and effect that general demoralization of the enemy's aim, which results from the concussion and indescribable din, to say nothing of the wreckage, of a storm of bursting shell. It seems to us that these conditions are excellently realized in the battery of the majority design of the Board on Construction. At the same time it is undeniable that Rear Admiral Bradford makes out a strong case in his minority report for the *tactical* advantages to be gained by mounting a numerous 8-inch battery in double- and single-decked turrets. The Bradford design has the advantage of possessing an overwhelming power of attack; although it gains this by the adoption of principles of construction that expose the vessel to the risk of a sudden disablement of a large portion of its main armament. The Bowles design, on the other hand, though less formidable for offense, is relatively simpler, less liable to quick disablement by a few well-placed shell, and with its larger secondary battery of 3-pounder guns, and the more rapid fire of its intermediate battery of 7-inch guns, would, in a given time, deliver many more aimed shots than the minority type of vessel.

However, after every argument has been made, one cannot but feel how purely theoretical is the whole question of battleship design. Only the test of a grueling fight between ships of opposite type could determine their respective merits. The Spanish-American war should have furnished the naval constructor with much of the proved data for which he is ever looking; but unfortunately the one-sided character of the engagements rendered the technical lessons of the war altogether meager and disappointing.

VARIOUS USES OF PAPER.

BY GEORGE E. WALSH.

Paper manufacturers have developed their industry in two ways in recent years, and the results justify all the labor and experiment carried on through the application of science and chemistry. The application of machinery to cheapen the process of converting the raw material into different grades of paper has enormously stimulated paper production in this country, and the various processes employed have often been described.

But a no less important expansion of the paper industry has been in increasing the manifold uses to which paper can be put. Here, too, science has been the chief agent, and it has wrought remarkable changes and improvements. Chemistry has been laboring in this field for two decades, and from the laboratory have come discoveries that have made possible the numerous side-products of the paper trade that are now manufactured on a large scale.

One of the things in the paper industry that seemed almost incredible a number of years ago was the manufacture of car wheels. It seemed incomprehensible to the lay mind that wheels made of compressed paper would stand the strain better than wheels made of steel. But the manufacture of paper wheels is no longer a novelty, and they are made in a great variety of sizes and shapes for use on roller skates up to heavy car wheels. After the car wheels made of paper were announced somebody applied paper to the construction of hollow telegraph poles, which were designed to take the place of those which had heretofore disgraced our streets and highways. But paper telegraph poles have never proved of any great value except to illustrate to the skeptical what can be done with paper.

There have in recent years been made of paper, water and sewer mains which promise to be of value. These are hardened and treated chemically so that they are more impervious to water than some of the iron and earthenware mains. It remains to be proved by actual test whether they can outlast some of the latter. The announcement was made a few years ago that paper window panes had actually been made and used, but these were much like the oyster-shell window panes of the Filipino huts. They may admit a certain amount of light to brighten up the interior, but they could never be looked through with any degree of satisfaction. Still, a semi-opaque glass is often needed for the ceilings of public buildings, where the light admitted must be dimmed and diffused in passing through the substance. Paper window panes have been used in this way with more or less success.

We are not only the greatest producers of paper in the world, but we have adapted it to more practical uses than any other nation. Our machinery for making paper, and for converting it into useful articles of commerce, surpasses that of any two European nations, and even in France and Germany, where the refinement of paper finishing has for years reached the high-water mark, our machinery is largely used. In fact, it might be said with considerable truth that our paper machinery has outstripped our paper production, and great as the latter is, the former eclipses it in extent and variety.

By means of improved machinery and new chemical processes wood pulp can be drawn out into the thinnest imaginable sheets. In this spinning and squeezing the paper does not lose its toughness. Thus thin paper napkins and table cloths are produced and printed with fancy borders and patterns. Some of these articles are almost as tough as linen in resisting the attempt to tear them. Of course, they will not stand wetting and soon lose their toughness when moistened. But otherwise they make serviceable substitutes for table linen. Likewise the paper vests and paper underclothing and lining of winter suits are prepared for practical use, and they accomplish nearly all that is claimed for them. The paper vests and lining are made so thin that their weight is practically nothing, and yet they keep out the wind and cold. They are chemically treated, so that they will last a long time. They are also manufactured so that they do not make the rustling sound usually characteristic of paper, and they are pliable enough not to stand out or bulge the cloth in any way.

Waterproofing, and more recently fireproofing, of paper have occupied the attention of chemists and practical paper makers. Paper made waterproof and as fine as the ordinary napkins and table cloths would prove a boon to many lines of industries, especially at restaurants and hotels. It is said that public eating houses are waiting anxiously for durable paper napkins and table cloths. Waterproof paper is made to-day, but not in such a way as to be valuable for table use. Waterproof paper sheets are frequently glued to cloth, and in this way the latter is rendered impervious to moisture. This waterproof paper is good, however, only for limited lines of articles.

Lately the paper pulp mills have been experimenting with fireproof paper. In fireproofing wood it has been found necessary to inject into it under great pressure non-inflammable chemicals, and thus either drive out or neutralize the inflammable material of the wood. It has been found that these fireproofing substances can be introduced into the paper pulp much easier than they can be injected into wood. Many attempts have been made to mix the right chemicals in the paper pulp to render the paper made therefrom fireproof. Not a little success has been attained in these experiments. In fact, the experiments in producing fireproof paper paved the way for making fireproof wood. The wood pulp that is compressed into molds for general household uses, such as for wainscoting, dadoes, ceilings and moldings, can be made fireproof in the same way as the paper. The fireproofing material is introduced and mixed with the wood pulp when the latter is in a soft, pliable condition, and when hardened through hydraulic pressure the chemicals remain in the wood.

This is one of the most interesting lines of experiments yet attempted by the wood pulp mills. It opens up a world of new possibilities. Should they succeed in producing perfect fireproof wood pulp there would be nothing to prevent them from furnishing our builders and marine architects with nearly all the interior wood trimmings in pressed material. The demand for such fireproof wood pulp products would be extensive. Our Navy Department is demanding such material for their battleships and cruisers, and the builders of the great skyscrapers in our cities are just as anxiously looking around for the same thing. If fireproof wood pulp could be produced satisfactorily it would enter into our daily lives in innumerable ways.

When we consider the great number of household articles already made of wood pulp, it can readily be understood that a fireproofing process for paper and wood would be immediately of great value to all. The interior trimmings of railroad cars, ferryboats, ocean and river steamers, public halls and hotels are nearly all made of hard wood treated with oil, so that it is more inflammable than in the natural state. All this trimming of wood forms a daily menace to thousands of people, and should a fire occur it would sweep irresistibly through these handsome steamship saloons and parlor cars. The whole trade is merely waiting for the proper fireproof wood to make revolutionary changes in its methods.

There are innumerable smaller trades built up in recent years as the result of improvements in manufacturing paper. Thus in the electric light business compressed paper, chemically prepared, is of great value, and it is employed for insulating purposes on a large scale. Paper is in increasing demand for packing perishable goods. Butter, cheese and similar products packed in waterproof oiled paper will keep twice as long as when wrapped in any other substance. This packing paper is rendered absolutely air-tight. Druggists use large quantities of it for wrapping around the corks of their bottles, and even in sealing up boxes of medicine which need to be kept from the air as much as possible. In this way results are obtained which cannot be approached by any other cheap material. Filter papers are also articles of considerable commercial value. Thousands of tons of fine filtering paper are used every year in the drug trade.

SCIENCE NOTES

The Olympic Theater at Vincenza has been reopened with the Œdipus of Sophocles. We illustrated this wonderful building in the SCIENTIFIC AMERICAN for July 16, 1898.

The Baldwin-Ziegler expedition sailed on the exploring ship "America" from Vardoe July 31, the vessel's course being shaped for Cape Flora, where Mr. Baldwin hopes to join the "Frithjof" and "Belgica." Mr. Baldwin intends to push as far north as possible to establish winter quarters. He has 426 dogs and 16 ponies with him.

The Arctic expeditions of 1901 include the Baldwin-Ziegler expedition, the Russian expedition under Admiral Makaroff, the Canadian expedition, the German expedition, the joint expedition by the Duke of Abruzzi and Nansen, Peary's Greenland expedition, the Stein Ellesmere Land expedition, a Russian expedition in the Kara Sea, to work to the eastward along the Siberian coast, and an expedition to Franz-Josef Land.

Count de la Vaulx, the aeronaut who will attempt to cross the Mediterranean in a balloon in the middle of August, has arrived in Toulon to superintend the preparatory arrangements. Many prominent persons have contributed to the cost of the experiment. An immense balloon shed opening toward the sea will first be constructed. A carrier pigeon post will be established along the coast from Barcelona to Nice, and at Corsican and Algerian ports, with which the aeronaut will communicate.

The New York Police Department has adopted a button invented by a woman, Mrs. Dudley F. Phelps. She has been working on the invention for many years. The button requires no sewing of any kind and can be taken off, cleaned and put back again without tearing the cloth. When she designed the button she had in mind particularly the requirements of uniforms. Two small prongs pierce the material of the uniform and on these fits the top like a glove fastener, which makes the whole thing perfectly secure.

A London firm of photographic apparatus makers, during the sojourn of the Moorish ambassadors, constructed a camera for the Sultan of Morocco at a cost of $10,500. The instrument is of the quarter plate size (3¼ x 4¼) and differs in no respect as regards the fittings from the ordinary camera made by this firm for general purposes. The metal work of the camera is constructed of gold, including the screws, and also the holders for retaining the plates. The instrument occupied the services of ten men for four months, the polishing of the base boards alone requiring eight weeks to accomplish. About 150 ounces of gold have been utilized and the instrument weighs 13 pounds instead of 5 pounds, the weight of the same camera for ordinary use. It is a combination hand and stand camera with double extension racking out from the center and rising front. It has but one lens, a Zeiss working at *f* 6.3. It gives two different foci, and it is stated that the powerful actinic light of Morocco will render the open aperture sufficiently rapid for the focal plane shutter, permitting an exposure of 1-1000th part of a second being given. The iris diaphragm, stopping down to *f* 45, will enable the lens to be employed for interior or sharply defined photography. Another camera was also made by the same firm—half plate in size—but in this instance silver is employed instead of gold for embellishing it. The cost of the second camera was $4,500. The Sultan of Morocco is stated to be an expert amateur photographer.

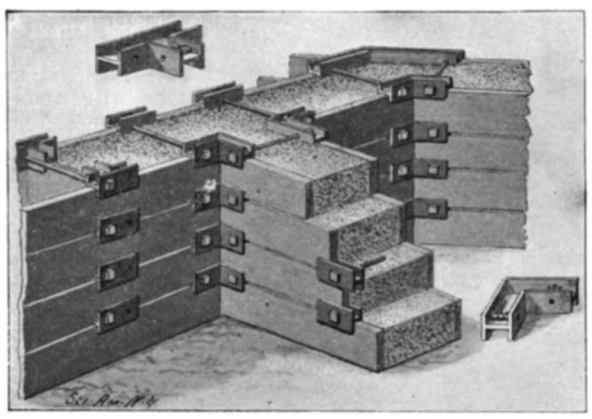
H. Becquerel has confirmed, by an unpleasant experience, the fact first noted by Walkoff and Giesel, that the rays of radium have an energetic and peculiar action on the skin. Having carried in his waistcoat pocket for several periods, equal in all to about six hours, a cardboard box enclosing a small sealed tube containing a few decigrammes of intensely active radiferous barium chloride, in ten days' time a red mark corresponding to this tube was apparent on the skin; inflammation followed, the skin peeled off and left a suppurating sore, which did not heal for a month. A second burn subsequently appeared in a place corresponding to the opposite corner of the pocket where the tube had been carried on another occasion. P. Curie has had the same experience after exposing his arm for a longer period to a less active specimen. The reddening of the skin at first apparent gradually assumed the character of a burn; after desquamation a persistent suppurating sore was left which was not healed fifty-six days after the exposure. In addition to these severe "burns" the experimenters find that their hands, exposed to the rays in the course of their investigations, have a tendency to desquamate, the tips of the fingers which have held tubes or capsules containing very active radiferous material often become hard and painful; in one case the inflammation lasted for fifteen days and ended by the loss of the skin; and the painful sensation has not yet disappeared, after the lapse of two months.—Comptes Rendus.

A COMBINED BOX-CAP AND SHOE-PLANK HOLDER.

In order to facilitate the construction of concrete walls, piers, columns, and the like a very efficient combined box-cap and shoe-plank holder has been devised by Mr. Thomas C. Farrell, of Washington, N. J.

As our illustration shows, the mold for the concrete wall is made of planks set on edge, the combined box cap and shoe-plank holder for these planks comprising vertical sides connected by a horizontal web, giving the construction an H cross-section. The webs have small spurs which firmly engage the planks. The combined box-cap and shoe-plank holders are connected in transverse pairs by tie-bolts.

The combined box-cap and shoe-plank holders thus constructed may be given any desired form. The T-form is useful at the end of a wall; the straight form is



BUILDER'S MOLD FOR WALL CONSTRUCTION.

employed to join together the meeting ends of two of the planks and also to strengthen the planks at points between their ends; the L-form is used when a rectangular branch of the wall is to be made; the obtuse-angled form is designed for use at the inside of a branch to or bend in the wall; and the Y-form is to be used at the outside angle of an obtuse bend.

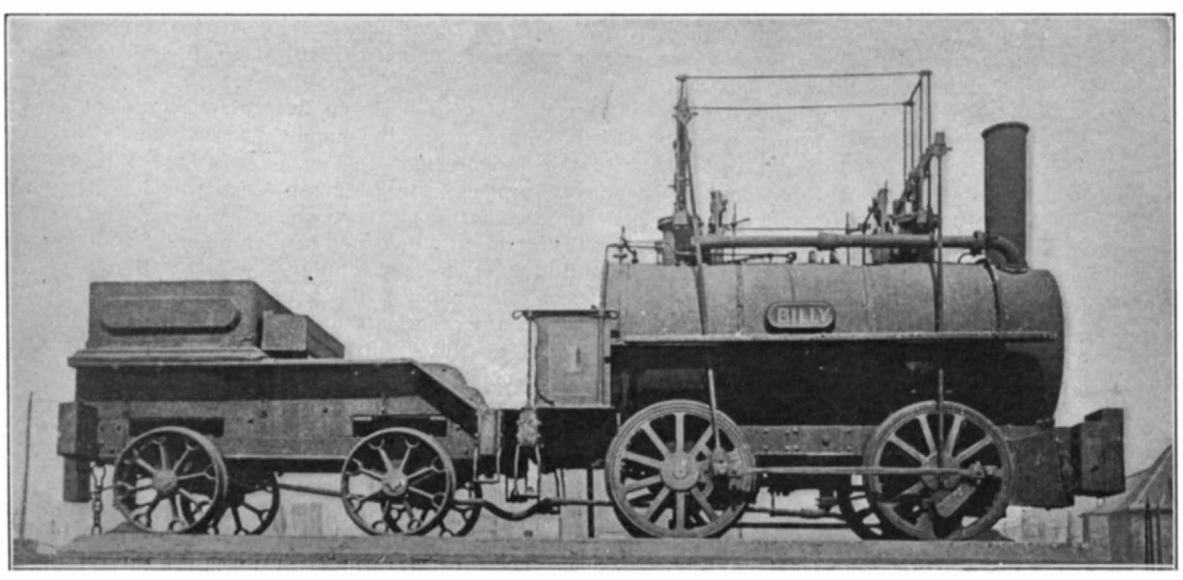
In building up a wall, four or five courses of planks are placed on top of one another—sufficient to give the foundation its proper strength. The lower planks are then taken out and used again at the top of the wall, the concrete being filled in as before. The wall may therefore be built to any desired height without the use of a continuous sheathing.

By means of the invention any intelligent practical builder can construct a fire-proof dwelling without the use of timber or stone as building material.

STEPHENSON'S LOCOMOTIVE.

The accompanying photograph represents the first locomotive built by George Stephenson, which was constructed for the Killingworth Colliery Company, in the year 1814. After doing its share of useful work as one of the notable pioneer locomotives, it came into the possession of Sir Charles Mark Palmer, who presented it to the mayor and corporation of the city of Newcastle-on-Tyne, England, on the occasion of the centenary of the birth of George Stephenson, which occurred June 9, 1881. This curious little engine is preserved as a relic of the past on a platform of the Northeastern Railway Company's Central Station at Newcastle-on-Tyne. It should be noted, however, that the "Billy," as it is called, has been somewhat modernized since the day when it first left the hands of its builder. Originally there was no smoke-box, nor were there, as explained below, any coupling rods. The boiler consisted of a cylindrical shell, with a single horizontal, cylindrical flue extending through it. The rear end of the flue constituted the firebox, and at the front end it was connected by an elbow with a vertical smokestack. The sheet-iron side to the foot-plate, on which it will be noticed the figure 1 is printed, is evidently a later addition. Two vertical steam cylinders were carried above the boiler, into which they were built, the lower half of the cylinders being contained within the boiler itself. The piston rods are connected to transverse cross-heads, from the ends of each of which a pair of connecting rods are coupled to the driving wheels.

As originally constructed, there were no coupling rods, the desired relative position of the pairs of cranks on each pair of drivers being maintained by a chain-and-sprocket gear between the two axles. On the front driving wheels was a return crank, which, with the coupling rods, served to keep the pistons in quarter position. The coupling rods were substituted in 1825. The frame of the engine is of wood, and the wooden tender is provided with a tank which is carried over the rear axle, as shown in the engraving.



FIRST LOCOMOTIVE BUILT BY GEORGE STEPHENSON.

Experiments Upon Value of Color Solution for Orthochromatic Plates.

A series of interesting researches has lately been made at the Imperial School of Graphic Arts of Vienna upon the subject of preparing orthochromatic plates from ordinary gelatine plates by sensitizing them with different solutions. Dr. Eder, whose researches in this direction are well known, has had the present series of experiments made by M. Paul Roch, an attaché of the Institute, and the latter has taken up and completed the previous experiments of Eder, Bothamley and others for comparing the sensitizing effect of a great number of color solutions for the different rays of the spectrum. The colors chosen were for the most part of the eosine group.

To find out the relative value of each of the solutions, a ray in the red was selected for comparison, and the spectrum was photographed each time with a plate sensitized with one of the solutions of the series; the effect of the sensitizer is then measured by the length of exposure necessary to produce the same deposit of silver, this effect being represented by a number inversely proportional to the length of exposure.

In this manner the following numbers were calculated. For all the colorants of the eosine group, the immersion in the color bath was preceded by a short immersion in a 2 per cent ammonia solution. The numbers thus determined confirm the previous experiments and give some new results.

Erythrosine	100
Bengal rose	50
Naphtofluoresceine	50
Methyleosine	50
Eosine	25
Cyanosine	25
Quinoline red	12
Chrysaniline	12
Fluoresceine	5

As the sensitizing power of erythrosine was found to be superior to all the others, it has been taken as a standard of comparison in the table. According to M. Roch, the method of using some of these colors is indicated in the following formulæ:

1. Erythrosine, methyleosine, ethyleosine, eosine:
a. Preliminary ammonia bath, 2 per cent solution.
b. Sensitizing bath.

Color solution at 2 per cent	6 parts
Ammonia	2 parts
Water	100 parts

2. Bengal rose:
a. Preliminary ammonia bath, 2 per cent.
b. Sensitizing bath.

Color solution at 2 per cent	2 parts
Ammonia	2 parts
Water	100 parts

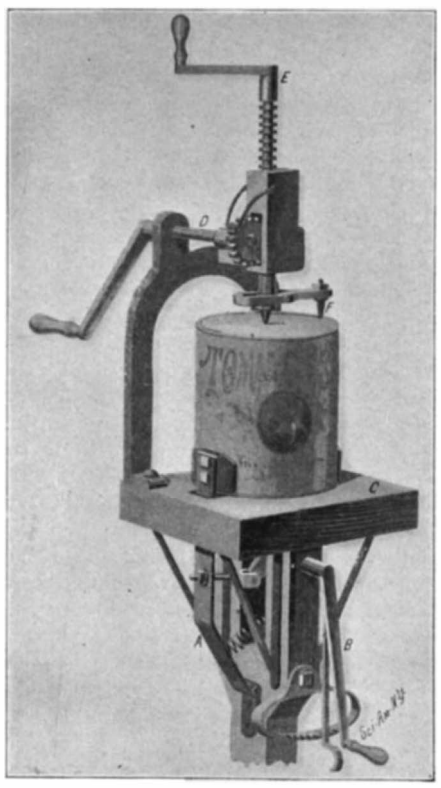
For naphtofluoresceine and cyanosine, 12 parts of a 1 per cent color solution are taken, the rest of the formula remaining the same. With quinoline red, no preliminary bath is used, and the sensitizing bath is made up with 1 to 2 parts of a 2 per cent color solution to 100 parts of water. It should be remarked that the plates rendered orthochromatic by the use of the color solutions cannot be kept for a great length of time before using; the best results are obtained immediately after drying. If, as is usually the case with amateurs, orthochromatic plates are not used continually, the fact of being able to sensitize one's own plates presents some advantages.

A train on the Burlington route recently had all the windows on one side broken by hail.

A NOVEL CAN-OPENER.

An ingenious machine for opening preserve-cans is the subject of a patent which has recently been granted to Truman A. Darling, of Anaheim, Cal.

As our illustration shows, the machine comprises a standard carrying a platform, *C*, and having two jaws, *A*, pivotally mounted on opposite sides of the standard and pressed apart by a coiled spring. An opening is made in the standard for the passage of



A MACHINE FOR OPENING CANS.

the spring. The jaws, *A*, pass upwardly through the platform, *C*, to grip the opposite sides of a can. In order to draw the jaws toward each other so that the can may be firmly clamped, links are employed, connected by a lever which is controlled by a crank, *B*. The crank is provided with a spring-pawl which works with a ratchet-bar fastened to the standard. By means of the spring-pawl and the ratchet, the crank, *B*, may be held in any desired position. By moving the crank the lever may be thrown to draw the jaws, *A*, together so as to engage the can; by throwing the crank, *B*, in the opposite direction the jaws are released and the coiled spring allowed to throw the jaws in open position.

The platform, *C*, carries an arch-shaped frame on which a crankshaft, *D*, is fitted. The crankshaft is provided with a pinion which meshes with the annular teeth of a vertical crankshaft, *E*, enclosed partially in a sleeve. A pawl is mounted on the sleeve to engage the pinion on the crankshaft, *D*, to hold it in any desired position. The lower end of the crankshaft, *E*, is formed with a point which is intended to pierce the center of the can-head. A transversely-disposed arm is adjustably held on the lower end of the crankshaft, *E*. The outer end of this arm carries a knife, *F*, which is intended to cut out the head of the can as the shaft, *E*, is rotated.

In using the machine the can is placed upon the platform, *E*, and the jaws, *A*, are engaged with its opposite sides by manipulating the crank, *B*. By rotating the crankshaft, *D*, the crankshaft, *E*, is moved down so that its lower point engages the head of the can. The same movement will bring the knife, *F*, into contact with the can. By throwing the pawl on the sleeve down, the pinion is held immovable; and by turning the crankshaft, *C*, once, the knife, *F*, will cut out the head of the can.

An experiment is being made in New York city in connection with the water supply for the condensing plant of the Edison Company at their new electrical power house in course of erection at Thirty-ninth Street and East River. A steel tunnel, 250 feet long, measuring 12½ feet in diameter, and weighing over 1,000 tons, has been built, and the intention is to sink the tunnel some 23 feet under water and to use it as a huge aqueduct to lead water from the river to the condensing plant referred to above.

THE ELECTRICAL CAUSES OF CHANGES IN THE WEATHER.

BY FREDERICK A. TALBOT.

Prof. Elmer Gates, of Chevy Chase, Md., has conducted a series of experiments which has led him to conclude that our varying conditions of weather are due to electricity. According to the professor, this subtle force produces rain and drought, the changes of air pressure, and the various meteorological disturbances, such as tornadoes and waterspouts, which visit us from time to time.

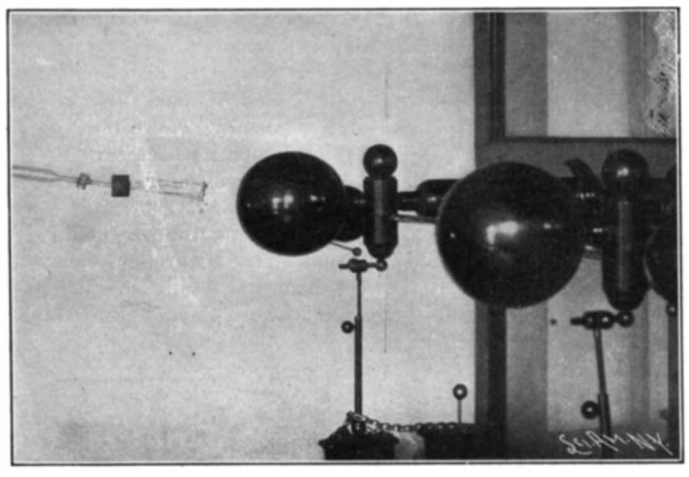
That electricity exerts a powerful influence upon the air pressure is proved by means of a simple experiment. A large fluffy ball of cotton suspended from the ceiling by means of a silken cord and charged with electricity immediately increases in size very appreciably. This expansion Prof. Gates explains as indicative of a low barometer, arguing that the expanding of the ball by charging it with electricity proves that the fibers of the cotton are repelling one another, so that the ball possesses less density. The same result attends the charging of the atmosphere with electricity. The density of the air is diminished, with the result that the pressure is decreased, and the barometer consequently falls.

The presence of electricity, however, in the atmosphere, produces not only low pressure, but high pressure as well. When two opposite masses of air charged with electricity—positive and negative respectively—approach one another, they become denser, with the result that the barometer rises. To prove this, Prof. Gates uses another ball of cotton, suspending it from the ceiling also by means of a silken cord about 2 feet distant from the first ball. In a few minutes the two balls approach each other, both decreasing in size. From this experiment Prof. Gates infers that when one mass of air becomes charged with electricity, a neighboring mass of air becomes electrified with an opposite charge by induction. Thereupon the masses of air gradually approach one another slowly, and decrease the density of the air.

One outcome of these investigations has been the construction of an appliance which Prof. Gates intends to use in forecasting the weather. It is impossible, with the present appliances employed, to predict the barometric pressure until a change has actually occurred; that is to say, until the barometer has either risen or fallen, meteorologists cannot tell us what weather to expect. If the variations of the barometer are the result of electrical influences, Prof. Gates suggests that the electric conditions of the atmosphere should be observed, and by this means foretell at what places and at what time the barometer will be either high or low. The primary object of his contrivance is to measure and to record the amount of electricity in different regions of the atmosphere. The device is to be attached to a small aerial apparatus which soars to the upper strata of air, makes automatic records at various heights, and then returns to the earth. By means of the appliance the professor hopes to glean information of those regions of air about which little at present is known.

That rain is produced by the mingling together of masses of air oppositely charged with electricity, Prof. Gates explains by another simple operation. Two windows on either side of his laboratory were opened. An electrical fan was placed in one window and set in motion for the purpose of withdrawing the air from the apartment. Thus the only air within the room was that which entered through the two windows. The weather outside was clear and bright, though the air was charged with a certain amount of humidity. The two currents of air entered the apartment by either window and mingled together in the usual way, without causing any untoward circumstance. A current of negative electricity was induced into the air entering through one window, and a similar current of positive electricity induced into the stream of air proceeding through the other window. A most remarkable phenomenon instantly occurred. The two oppositely electrified currents of air came into contact, formed a slight mist, and in a few seconds the floor of the laboratory was quite wet. Directly the electricity was switched off the air cleared, only to become misty again whenever the currents were switched on. This experiment was intended to prove that the electrified masses of moisture-laden air, generally termed clouds, when they meet, produce showers. When they are abnormally laden with electricity, lightning and thunderstorms result. If, for example, reverting, the two cotton balls are charged very highly with electricity they jump together with a spark and a snap, then spring apart and come together again with another spark and snap, separate once more, while the charge is maintained. This is practically an illustration of thunder and lightning upon a miniature scale. The spark represents the lightning and the snap the thunder.

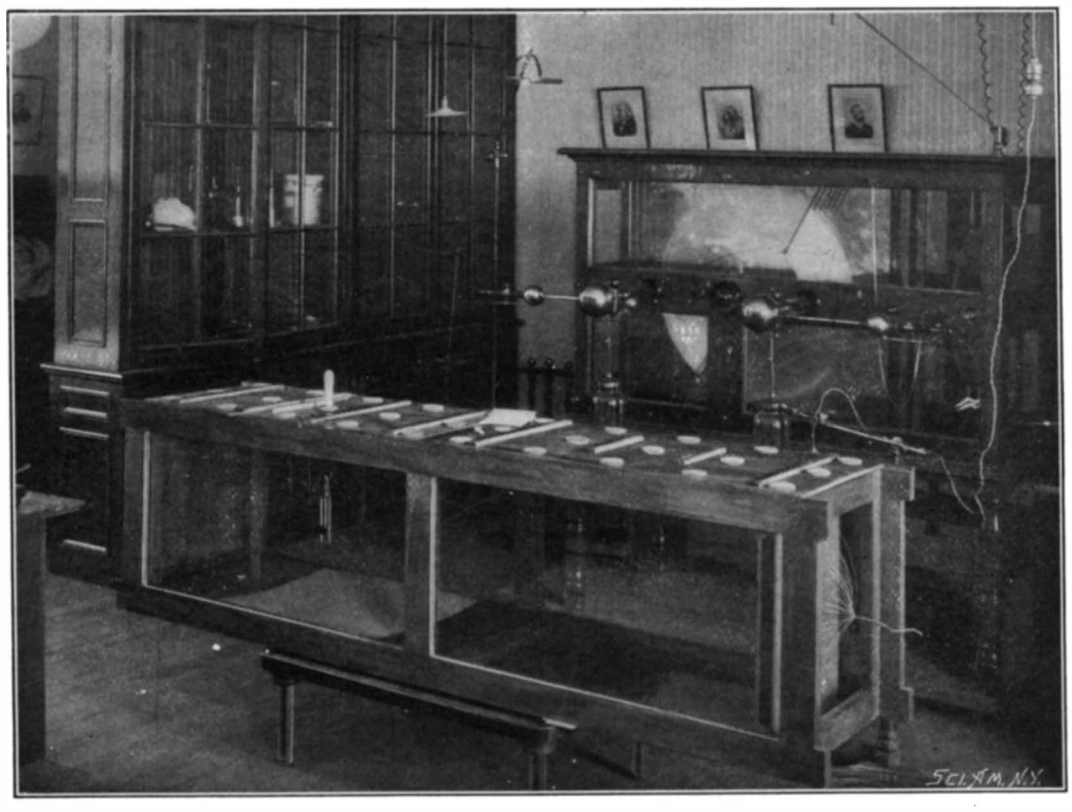
Prof. Gates, in the course of his experiments, also discovered another curious fact. This is the transportation of moisture from one point to another by means of electricity. During a shower of rain it has often been observed that a far greater quantity of



ELECTRICAL ATTRACTION SHOWING HOW CLOUDS MAY BE INFLUENCED BY ELECTRICITY.

rain has fallen in one place than could be possibly contained in the air covering that area. This peculiar fact is explained as follows: While it is raining in a certain spot, moisture from various directions is being conveyed to this special region by electrical energy. To illustrate this transportation possibility of electricity, Prof. Gates has constructed a large glass case about eight feet in length, divided into two compartments by means of a section of thin porous paper. One division is filled with very dry air and the other with air containing a heavy percentage of humidity. A wire leading from the negative pole of a static electrical machine is attached to the compartment containing the dry air, while another wire led from the positive pole is connected to the chamber containing the moist air. When the current is switched on, the moist air is transported from one end of the box to the other in a much shorter time than it would be conveyed by ordinary diffusion.

In addition to producing artificial miniature showers, mists, and thunderstorms, Prof. Gates contrives on a similar scale the more violent eruptions of nature, such as cyclones and waterspouts, with equal facility. To the bottom of an ordinary saucer filled with water a wire is attached, connected with the positive pole of the machine. A small rod connected with the other pole of the machine is held a short distance above the surface of the water. When the current is switched on, the water is agitated, the disturbance increasing in violence as the potential of the current is raised, until presently a cone is formed, rising higher and higher, until it ultimately touches the rod above.



ELECTRICAL APPARATUS BY WHICH EXPERIMENTS ON WEATHER CONDITIONS WERE MADE.

The British Antarctic Expedition.

The present year will be a red letter one in the annals of Antarctic exploration, inasmuch as determined efforts are to be made by the British Geographical Society and the German Government in concert, to unravel a little of the *terra incognita* of that remote region. Owing to its remote distance from the great centers of civilization, the South Pole has not received that attention from explorers which has been bestowed upon the North Pole, for whereas we are only 238 miles from the latter goal, we are yet about 770 miles distant from the South Pole. Yet it is imperative that our knowledge of these southern regions should be extended, in the interests of navigation, since owing to our meager information of the magnetic pole, ships sailing in these southern waters often stray miles out of their course and thus consequently protract their voyages unnecessarily.

The vessel in which the British expedition will set sail was recently launched at Dundee (Scotland), where she was constructed by the Dundee Shipbuilders Company, which makes a specialty of building whalers and other vessels for plying among the Arctic ice. As with the "Fram," in which Nansen set out for the North Pole, the "Discovery" has been specially built for the forthcoming task. In appearance she is a small, ungainly looking vessel, 178 feet in length, though she possesses fine lines. She is built of timber throughout and special attention has been devoted to the strengthening of her sides to enable her to resist the enormous ice pressure she will encounter. Her framing is constructed of Scottish oak, and where she will be subjected to the maximum pressure, heavy transverse bulkheads are supplied. There is a solid mass of wood 9 feet in thickness in her stem, while her sides amidships are 2½ feet thick. Her outside planking is of hard wood sheathed with greenheart and iron bark. Owing to the peculiarity of her form, when the ice exerts heavy pressure, instead of crushing the vessel, it will gradually lift her up.

She belongs to the auxiliary class of steam vessels, her engines developing only 450 horse power, and she will thus depend mainly upon her sails for progress. She is driven by three propellers fitted with new pattern withdrawing shafts and lifting screws, by which means, whenever an exigency arises, the screw shaft can be withdrawn inboard out of the way of the ice. Her boilers are the best return tube Scotch type. Her coal capacity is only 280 tons, but this is sufficient to carry her 8,000 knots at an average speed of 6½ to 7 knots per hour. She covered the 480 miles between Dundee and London with the consumption of only 14 tons of coal. She carries a steam dynamo and also a windmill dynamo to economize coal.

The internal arrangements of the vessel are as comfortable as possible. There is the usual range of laboratories and workshops incidental to such expeditions, and roomy quarters for the officers and crew. One prominent feature of the interior equipment is a kind of atmospheric lock by which means the raw Antarctic air is prevented from entering the interior of the vessel, when a person enters from the deck. It is a double-door arrangement, and when entering the person first closes the outer door before he opens the one leading into the apartment. To preserve the warmth in the rooms the walls are lined with asbestos. The stoves are provided with talc doors with funnel-like fittings over them, through which the air from the outside enters and is carried over glowing coals to be heated prior to its delivery into the rooms.

All the available space on the deck is occupied with winches, anchors, cables, sounding apparatus, spare propellers, masts, etc. For deep-sea soundings 10,000 fathoms of wire are being carried upon drums. The ship is lighted throughout with electric light. The magnetic instruments carried are of the most delicate description, and to prevent their being deranged no steel or iron

is located within a radius of 30 feet of them. All the rigging forward has in fact been specially made of hemp to prevent any disturbance in this direction. Kites are also being carried for the purpose of conducting the meteorological observations, and there is a possibility of Marconi's wireless telegraph system being installed.

The total cost of the expedition is $500,000. Sir Clement Markham, President of the Royal Geographical Society of Great Britain, who is himself an experienced Arctic explorer, was mainly responsible for the inauguration of the expedition. When he first promulgated the scheme he advocated its being carried out entirely by the Government, but this was found to be impossible. The latter, however, finally agreed to subsidize it to the extent of $225,000, the balance of the sum being defrayed by public subscription. A large amount of this has already been forthcoming. The expedition will be absent for three years, and the annual cost of maintaining it will be $100,000.

The leader of the expedition is Capt. R. F. Scott, of the Royal Naval Reserve. The officers and crew will in all number forty-five, an excess of fifteen over the strength of the German expedition.

The South Polar regions have been divided into four quarters or quadrants, named respectively, Victoria, 90 deg. to 180 deg. east; Ross, 180 deg. to 90 deg. west; Weddel, 90 deg. west to 0 deg., Greenwich Meridian, and Enderby, 0 deg. to 90 deg. east. The British expedition will explore the Victoria and Ross quadrants and the Germans will explore the Weddel and Enderby sections. Both expeditions will start simultaneously from Melbourne in the latter part of this year.

COKE MAKING IN THE CONNELLSVILLE REGION.

Of the coke industry it may be truly said that it has revolutionized the iron and steel trade of the world. To-day this great fuel industry ranks with the great industrial enterprises in which fame and fortune have been won. Coke-making, as now carried on in many States and Territories, had its birth in the Connellsville region of southwestern Pennsylvania. The originator of this industry never dreamed of the far-reaching effect it would eventually have on the iron and steel industries. To-day its effects are universal. Less than half a century ago the successful manufacture of coke in western Pennsylvania shifted the pig-iron industry to Pittsburg, and thus laid the foundation for that city's present industrial greatness.

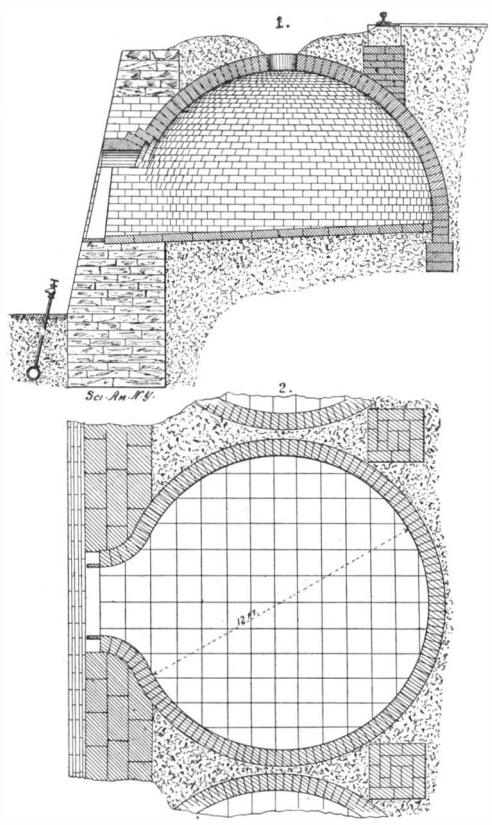
The Connellsville coking-coal seam embodies some peculiar geological conditions. It is a detached portion of the Pittsburg coal basin, and extends along the western slope of Chestnut Ridge, the westernmost range of the Alleghanies, from Latrobe, Pa., on the main line of the Pennsylvania Railroad fifty miles east of Pittsburg, southward into Maryland and West Virginia. Its average width is not more than four or five miles, and the region contains something over 100,000 acres, its borders having been somewhat extended during the past year or two through the introduction of improvements in the coking processes, whereby the production of a good quality of coke is made possible from the coal lying on the borders of the main coking field.

In the Connellsville region the standard bee-hive oven, the type now in general use, has a diameter of from 10 to 12 feet, and a height of from 6 to 8 feet, and is built of fire-brick or stone. It is arched in the interior, and has an opening in the top for charging and for the escape of the gases during the coking process, and a door in the lower front side through which the finished product is "drawn," this door being closed during the coking process. The average charge of coal per oven is from three and one-half to four tons, the heavier charge requiring more time for the coking process. When the charge is leveled it has a depth of from two and one-half to three feet in the oven, thus leaving sufficient room for the accumulating gas and for the expansion and rising of the coke during the processes of its manufacture. It is the practice to charge every other oven each day, and the charge is ignited by the heat retained in the walls of the ovens. The ignition is indicated by a puff something like a powder explosion. For twenty-four hours the gas is allowed to escape, and then the oven is closed up. Furnace coke in general use requires forty-eight hours for the coking process, while foundry coke is a seventy-two hour coke. The last twelve hours of the coking process are usually consumed in cooling. Pure water is essential for coke cooling. The object is to expel the water, hydrocarbons and the sulphur, and leave a fixed residuum of ash, carbon and such of the sulphur as cannot be driven off during the coking process. Should the water used in cooling the coke contain sulphur or other deleterious substances, these would be readily absorbed by the coke, and would injure the iron or steel manufactured with such coke.

The operation of the bee-hive oven is extremely simple. Nevertheless there have been numerous improvements in the ovens erected during the past two years, and especially is this the case in the coking fields adjacent to the Connellsville region, but not strictly in the main coking district. These new ovens are larger in size, have improvements in the way of draft, and electricity enters largely into their operation. The mines which supply these new ovens are lighted with electricity, electric mining machines are used, and electric haulage shaft and tipple operations have been largely introduced. Electricity has supplanted the old "Larry" for the purpose of charging the ovens, and electric and automatic coke-drawers and car-loaders have supplanted hand labor. One great trouble with the bee-hive oven is the impossibility of obtaining by it an absolute uniformity of the product.

To improve the process of manufacture, larger charges and increased natural air drafts have been employed, but with no decided results. The bee-hive ovens erected during the past two years are somewhat larger in size than the old ovens. There have also been various minor changes. In the bee-hive oven the mass of coal, as it fuses into coke, swells and rises. If, on quenching, it falls back to its original bulk, it makes a hard coke; if not, a soft coke is the result. There is also a lack of uniformity of porosity which is necessary to give toughness and hardness to a furnace or foundry fuel.

The general reduction of the coking industry to a science awaits the introduction of the by-product coke oven wherein the coal is coked in an airtight chamber and an absolute uniformity of the product is assured.



SECTION AND PLAN OF BANK OVEN.

In Number 1108 of the Scientific American Supplement the writer gave something of the progress of these ideas up to that time, together with a comparison of the economy which would result from the introduction of this coking system. So here it will suffice to say that the coke yield under the by-product system would be 73 per cent of the coal charge against 66 per cent by the bee-hive system. The resultant economy through the utilization of the by-product would amount to at least sixty cents for each ton of coal coked, and for the 20,000,000 tons coked in the Connellsville region during 1900 the by-products which are now a total waste would represent $12,000,000. However, during these days, when there is such a great demand for coke, there is not likely to be any great progress by these new coking ideas.

One of the features introduced into the coke business by the H. C. Frick Coke Company is coke crushing. This company has now in operation three great crushers, each having a daily capacity of 2,000 tons. The coke is crushed into sizes corresponding to anthracite coal and is shipped all over the country for various manufacturing and domestic purposes. This and other firms manufacture a special seventy-two-hour foundry coke which combines to the highest degree the requisites of a foundry fuel.

During the past twenty years there has been a wonderful railway development in the region, and to-day the numerous roads in this district are the most profitable in the country. The coke shipments by the Pennsylvania, the Baltimore and Ohio, and the Pittsburg and Lake Erie lines of the Vanderbilt system at present exceed 200,000 tons weekly. The past year has been the most prosperous in the history of the coking industry, the output of this region having exceeded 15,000,000 tons. Over 8,000 new ovens have either been completed or were in the course of construction during the year and many million dollars have been expended in the further development of the region. Since the birth of the coke industry here in the Connellsville region the industry has been established in twenty-six States and Territories, but this region still retains its pre-eminence.

Traveling Beehives.

California is an ideal home for apiculturists, and one of the most progressive bee-keepers, noticing that the activity of the insects depended upon the coming of spring flowers, conceived the idea of assisting them to set out earlier on their yearly campaigns. The orchards of the Sacramento and San Joachim valleys burst into bloom some months before the southern sage brush, and to them Mr. Graham drove a wagon-load of bee colonies late in January, 1896, says The New York Tribune, to which we are indebted for our information. The journey was an easy one, as the bees had not really aroused themselves. In February the fragrance of the trees stimulated them, and they set to work. As the blossoms faded in April, Mr. Graham turned southward again. He traveled by night only, and reached home with practically full colonies, a honey crop of one hundred pounds to each hive, and the sage brush was still open before him. The following two years he moved two wagon-loads of colonies, and he was able to obtain three distinct crops of honey, keeping the bees active during nine months of the year. Since 1899 Mr. Graham has shipped the bees by car-loads from one feeding ground to another. He has had built from his own designs a wagon the size of a common flat-car and a crate that exactly fits this wagon. At night he loads the colonies in the crate, about 300 in each, and at the railroad station slips the crate upon the flat-car. Then the wagon is taken apart and all are shipped to their destination. On their arrival, again under cover of darkness, the crate is slipped from the car to the readjusted wagon, and the colonies are wheeled off and established in their new feeding ground. Mr. Graham scatters the bees around the fruit region in the proportion of about a hundred colonies in an area of five square miles, and pays a certain ground rental for the season. As the bees help pollenize the flowers and thus produce a superior fruit, the owner of the orchard is reaping an equal benefit with the apiculturist, if not a greater one. One raiser of alfalfa in Southern California estimates so highly the help of the bees that he invited the bee-keeper to locate permanently on his farm, sharing the profits of his hay. The partnership was continued for several years and both are well satisfied with the results.

In addition to outfits for transferring the bees Mr. Graham takes with him a regular camping wagon and all the apparatus for extracting honey from the comb. When the combs are full the equipments for straining are placed in the camping wagon. The honey is strained, and shipped to the market from the nearest railroad station. Among the fruit blossoms and the spring wild flowers the bees take about fifteen days to fill their combs, and during that season they produce about one hundred pounds of strained honey to a colony. In the sage brush the combs are filled within ten days, and each colony gives about two hundred pounds in the season.

Meteorology of London.

The annual report of the Greenwich Observatory, published the 1st of June, contains the following figures relating to the meteorology of London. The mean temperature for the year has been 10.3 deg. C., or 0.6 deg. above the normal (9.7 deg.) of the period of 50 years from 1840 to 1890. From May 1, 1900, to April 30, 1901, the absolute maximum observed at London has been 34.4, 33.2 and 34.1 deg., measured on the same day (July 16) at three different stations. This maximum has not been reached in the month of July since 1881, and since 1841 it has only been exceeded twice, namely, the 15th of July, 1881 (36.2 deg.), and the 22d of July, 1868 (35.9 deg.). During the last 60 years the mean temperature for the month of July, 19.2 deg., has only been exceeded four times; in 1852 (19.4 deg.), in 1859 (20.1 deg.), in 1868 (20.1 deg.) and in 1876 (19.3 deg.). December has been exceptionally warm, having a mean temperature of 7.6 deg., which is 3.3 deg. more than the average of the 60 years preceding. It has, however, been exceeded three times during this period; 8.7 deg. in 1852, 7.8 deg. in 1868 and 7.7 deg. in 1898. The minimum, —6.5 deg., was observed on the 14th of February. The thermometer fell below 0 deg. C. during only 47 days, which is much below the average number. Mean speed of the wind has been 20.4 feet per second, slightly above the average for the 33 years preceding. The sunshine record, measured by the Campbell-Stokes heliograph, is 1,513 hours for 4,457 hours during which the sun was above the horizon, or 34 per cent. The total rainfall is the lowest since 1894; or 20.1 inches in 151 days, this being less than the average for 50 years by 4.3 inches.

Correspondence.

The Export Edition of the Scientific American in Europe.

To the Editor of the SCIENTIFIC AMERICAN:

I write to thank you for the numbers of the monthly SCIENTIFIC AMERICAN which you have kindly and with such regularity sent to this office.

It is a splendid publication, and is destined to aid in great measure the inevitable development of the export trade of the United States, to accomplish which the Consular Corps is using all its best efforts.

For my own part I may say that having brought your last numbers to the attention of persons inquiring here, and having translated certain details for them, more than thirty inquiries for catalogues and prices have been sent from here in the past few days.

HAROLD S. VAN BUREN, Consul.

Office of U. S. Consul, Nice, France, July 17, 1901.

To the Editor of the SCIENTIFIC AMERICAN:

While in the United States before coming out here I used to read with deep interest the SCIENTIFIC AMERICAN, and occasionally I see it in Syria. But the Export Edition I have not had occasion to examine until now. It certainly deserves high praise. My experience tells me at once it will prove a great help to us in our endeavors to promote trade with the United States. The Prices Current it carries strikes me as a most valuable feature. While French as yet is the leading commercial language in the Levant, local commission men will, I know, find your export journal most useful. We shall esteem it a great favor if you will place this Consulate permanently on your mailing list. You may rely on us doing all in our power to assist you in your good work.

G. BIE RAVNDAL, Consul.

Consular Service, U. S. A., Beirut, Syria, June 12, 1901.

Automobile News.

The German army, in the next grand maneuvers, is to make a thorough series of tests upon different types of military automobiles, which will complete the tests commenced two years ago, and whose results were excellent. For this year's trials the Reichstag has voted about $35,000; one of the main questions will be the transportation of gasoline and petroleum so as to avoid accidents, and another question is that of following the troops with the machines over sandy or otherwise bad roads. It is considered that the automobile will be especially useful in modern engagements, where the line of battle will be greatly extended, as it will allow the general to remain in rapid communication with the troops. It is also proposed to use the automobile for the service of campaign hospitals, for aerostatic parks, for luminous signals and for the transportation of troops and baggage.

Since last year the Paris Fire Department has been experimenting with different types of electric automobiles, such as fire pumps, hook-and-ladders, hose-carriages, etc., and these have proved very successful in general. They present a decided advantage over the old forms in allowing a quicker start from the station and an immediate putting in use when on the ground. The value of this increase of speed is apparent, where the gain of a few minutes may be of vital importance. The first machine to be tried was a "fourgon," or wagon carrying six men, hose, ladders and fire-extinguishers. The motor, of the Bouquet, Garcin & Schivre type, is of 4,000 watts capacity and the accumulators, which give 200 ampere-hours, weigh 1,500 pounds. This vehicle measures about 6 by 10 feet and weighs 4,840 pounds, or 6,820 pounds when in running order. The electric fire pump was the next to be tried. It carries a pump worked by an electric motor and fed by a water-reservoir containing 150 gallons; this water supply (or other fire-extinguishing liquid) is utilized until the hose can be connected directly to a fire-plug. The same motor is used to drive the vehicle and, when on the spot, to work the pump. In this way it starts almost instantly and upon arriving at the fire sets immediately to work. It has a front seat with the steering devices and in the center is the battery-box, suspended below the vehicle; above it is the motor, of the same type as the first vehicle, which drives the rear wheels. The reservoir is in the rear and above it is the hose-reel, the water being taken to the hose through the hollow axle. The pump, back of the reservoir, has three vertical cylinders, and delivers 20 gallons per minute at a pressure of 4 atmospheres. The vehicle has an electric brake, besides a cord-brake; it weighs 5,060 pounds, or 6,380 pounds when fully equipped, including 3 men and 100 gallons of water. The motor gives 4,000 watts and the accumulators 180 ampere-hours. An arrangement is provided for using part of the current for lighting the scene of disaster by incandescent lamps, or even by arc lamps. These two machines have been repeatedly tried in actual service and have proved quite successful. A newer machine is the hook and ladder, which is rather in the experimental stage.

Engineering Notes.

It is probable that Pittsburg will have a system of elevated roads in the near future.

Russia now occupies a very important place in the world as an iron producer, coming between Germany and France.

Philadelphia's City Hall, which was begun in 1871, has cost $24,313,455. The largest single item of expenditure was for marble, $5,467,503.

Civil engineers consider that the dome of St. Paul's, in London, is unsafe, owing to cracks which have appeared in the walls, and the Dean of the Cathedral has decided to have an expert inspection.

There is a considerable use of gas as a motive power in the cities of Denmark. Most of the gas engines are manufactured in Denmark, although there is some importation of German and American machines. The prices are 15 to 20 per cent higher than in the United States.

James E. Mills, of San Fernando, Mexico, died July 25. Mr. Mills was a prominent mining engineer and geologist, and was at one time an assistant to the late Louis Agassiz. Mr. Mills made the first geological maps of the northern section of the Sierra Nevada Mountains.

By 1906 France will have a fleet of 68 submarine boats when the present programme is fulfilled. Twenty submarine boats have been laid down this year, and owing to this large number none will be laid down in 1902. Five will be begun in 1903, and in 1904 26 more will be undertaken. Three will be ready next year, and 17 more in 1903.

An immense oil tank holding 1,260,000 gallons has been built in San Francisco for the Street Railway Company for storing oil fuel for use in the power house, as a substitute for coal. The oil can be bought and delivered at an expense not exceeding 72 cents per barrel. From this tank the oil will be distributed to the various power houses by tank wagons.

Musical instrument makers of France and Germany put imitation graphophones on the market in the expectation that they could manufacture them more cheaply than the American makers. The rival articles were distinctly inferior, and instead of there being a price-war the quality of the American product was insisted upon, and the result is that at the present time the imitations are practically driven from the field.

On the Lancashire and Yorkshire Railway system, the engines and freight trains are graded into six classes, and schedules have been drafted showing the load which each engine is expected to haul over each section of the line. The object of the new plan is to reduce the number of trains by getting as much work out of each engine as possible, the gross load being graduated to the maximum tractive power of each locomotive.

The cruiser "Leviathan" for the British navy was recently launched on the Clyde from the shipyard of Messrs. John Brown & Company. When completed this vessel will be the heaviest cruiser afloat, even excelling those built for the Japanese navy. She is the first of what is known as the "Drake" class, and was ordered in 1899. The vessel is 500 feet in length, and displaces 14,160 tons. The engines are to develop 30,000 horse power, which will produce a speed of 23 knots. Her armor is also considerably heavier than that of any other ship of her class.

Lloyd's Register inspects marine boilers when new, again at four years, at six years, and then annually; they are, however, supposed to be inspected every three months by the chief engineer of the vessel they are in and also by the superintending engineer. In this country marine boilers have to be inspected every year by the Steamboat Inspection service, and are in addition constantly inspected by the engineers of the ship. The boilers of vessels on six-day runs or four-day runs are inspected on every trip, particularly where corrugated funaces are in use in this country.

The British Naval Department has devised an ingenious method of fighting submarine vessels, and a good test of the method was given during the recent visit of the Lords of the Admiralty to Portsmouth. The torpedo boat "Starfish" was selected for the experiment. The plates on the starboard side of the vessel were strengthened and a boom 42 feet long was attached, the upper end resting on a crutch. To represent the submarine boat a large barrel was submerged about ten feet below the surface of the water. The torpedo boat steamed by this target, and when within striking distance the boom, to which an outrigger torpedo containing a charge of 32 pounds of guncotton was attached, was dropped overboard. The forward impetus of the vessel drove the free end of the boom and the outrigger down into the water, and at the critical moment the guncotton charge was fired by electricity. The explosion that followed was most destructive in its effects. It was calculated by the experts on board that any submarine boat within a radius of twenty yards would have been totally wrecked.

Grand Jury Makes Presentment Against the Central Tunnel.

The grand jury of New York County has made a presentment against the New York Central tunnel in Park Avenue. The presentment in part is as follows:

Various citizens having complained to the grand jury of the conditions of the Park Avenue tunnel, and of the dangerous consequences resulting from the operation of numerous trains running through it, we have deemed it to be our duty to make a thorough and complete investigation of the tunnel, of its structural defects and of the conditions attendant upon the present method of its operation.

During this investigation the grand jury, with the able assistance of the District-Attorney, have examined not only the most available expert witnesses, but many persons who are compelled to ride through the tunnel, or who live along its line, besides several officers and employes of the railroad companies.

Estimating the amount of pure air necessary for each passenger, it appears that a coach when filled contains on entering the tunnel pure air sufficient (if uncontaminated) to last about one minute. The fumes, gases, smoke and steam emitted by the locomotive find entrance into the coaches, and further pollute the already contaminated atmosphere, and the passengers are thus compelled not only to rebreathe the vitiated air, but are also subjected to additional peril from these gases. To the discomforts and dangers thus created must be added the vitiation caused by lighted lamps and heat radiated from locomotive boilers. When the number of trains passing through the tunnel daily is considered, it is not at all surprising that the air within it is not comfortably or safely breathable. Temperatures exceeding 100 degrees are frequent with humidity at the point of saturation, and the oxygen of the air replaced by stifling gases, which are wholly unsuitable to be taken into strong lungs, and highly dangerous to weak lungs. Unless steps are taken by the company to improve these conditions the nuisance will be a continued and increasing one.

From evidence adduced before it the grand jury is convinced that in the present state of the art of electrical application to mechanical ends the progress has been so general and uniform that everything requisite for an electrical installation and its approaches is as standard at the present time as steel rails or car wheels; that to install electrical traction in these tunnels and the approaches thereto everything required can be had without difficulty, delay or great initial expense.

Evidence presented shows beyond question that bituminous coal is used in locomotives passing through the tunnel. The utilization of this fuel within the city limits is contrary to law, and we charge the Health Department of this city with the responsibility of seeking out violations thereof; we think that the Health Department has been lax heretofore, but we are satisfied that the present administration of the department will co-operate with other branches of the city government to relieve passengers on the road and residents along Park Avenue from the annoyance thus caused.

As a result of the investigation of the conditions existing in the tunnel, as above briefly summarized, the grand jury present to the court, the officers and directors of the various railroads operating within this tunnel, as maintaining a public nuisance, and recommend that vigorous and speedy action be taken to abate the same.

Further we recommend:

First—That the brick walls dividing the tunnel be promptly removed, and that steel columns and girders be substituted therefor.

Second—That passenger coaches while not in use during the day be protected from the sun by a shed.

Third—We further recommend that inasmuch as the most eminent engineers assert that there is no remedy for these existing evils so long as coal-burning locomotives are in use, that the railroad companies be compelled by and under such laws as may be provided for that purpose to change forthwith the motive power within the tunnel and its approaches to some method of propulsion as will not, as heretofore stated, endanger the public comfort and health.

The Elberfeld-Barmen monorail electric railway is operating satisfactorily. There are twenty-six cars in use at the present time and new cars are being made. The cars are running on intervals of about two and a half minutes and are occasionally overcrowded. The doors cannot be opened before the conductor has released the electro-magnetic bolt.

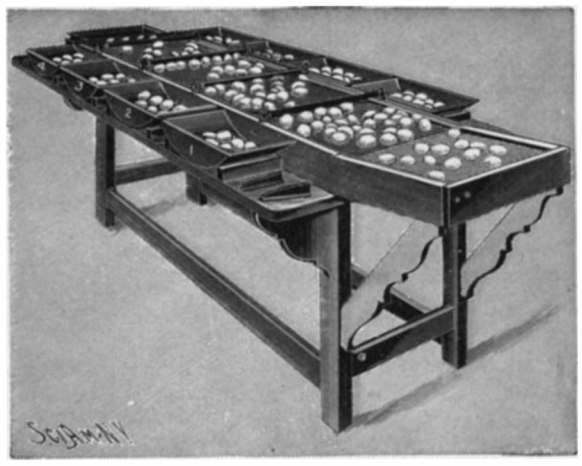
A railroad company that operates coal mines in Pennsylvania recently prevented its striking miners from interfering with non-union workmen, who were employed in pumping water out of the mines, by building a barbed wire fence 7 feet high about the pump-house and dynamo plant and then charging it heavily with electricity.

THE EXAMINATION AND SORTING OF EGGS.

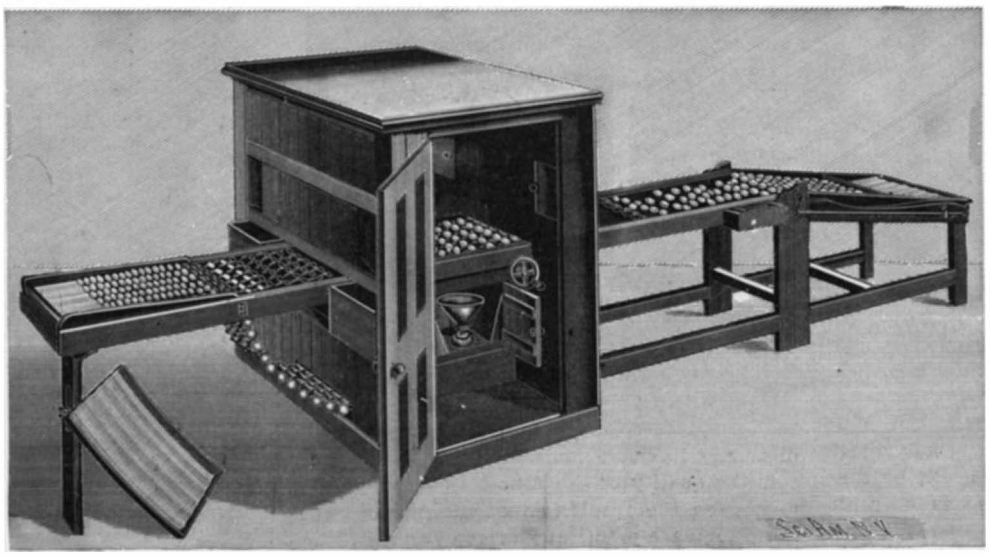
The egg is to the kitchen what verbs are to speech. It is the necessary adjunct of the majority of sauces, of all thin stews, and of a large number of side dishes. It is, in addition, a nutritious food that passes through the digestive tracts without fatiguing them, and that becomes assimilated in our organism without leaving any residue therein. It contains within itself all the elements of our meals and constitutes a true bill of fare in miniature, in which bread and cakes are represented by the glucose and extractive matters, in which the albumen takes the place of a roast, in which butter abounds in the form of fatty matter, in which the chlorides, lime, magnesia and iron are not wanting, and in which occur in small quantities the lecithine and phosphates that concur in the development of the bones. It is, upon the whole, a complete aliment which, like milk—and, in many respects, like the grape—affords, without resistance to digestive action, the materials that enter into the composition of the blood.

The newly-laid egg is entirely filled with yolk and white enveloped by a fragile shell. It is at this moment that it possesses its highest alimentary qualities. These it would be capable of preserving indefinitely, if the tightness of the shell equaled that of a metallic box. But, unfortunately, such is not the case. The calcareous shell is provided with pores, through which is soon established a cross circulation of water and microbes. The water leaves the albumen and passes to the exterior in the form of vapor, while legions of bacteria enter and fill the air chamber formed by evaporation. This latter causes the egg daily to lose, on an average, half a grain of its weight. We can assure ourselves of this by immersing it in a quart of water containing four ounces of salt. On the first day, it will descend to the bottom; on the second it will not sink to so great a depth; on the third, it will remain near the surface; and, beginning with the fifth, it will project above the surface so much the more in proportion as it is older. Such behavior of the egg in salt water may, up to a certain point, be used as a means of control. The loss of weight would not be of so much importance if it did not keep pace with the entrance of microbes.

Now, it is precisely the injurious action of the latter that restricts our consumption of so valuable a food material. Many people, not very sure of the age of the eggs exposed for sale by grocers, prefer to do without them rather than run the risk of being deceived in their purchase. The egg trade, as it is carried on to-day, especially in France, leaves much to be desired. The production of eggs, too, is, as a general thing, the result of chance. Upon farms, hens lay just about as they please, and the person who derives the greatest advantage therefrom is not the farmer, but the egg collector—an individual who leads a nomad life and who makes a business of profiting by the labor of others. In his daily travels among the farms, he collects the eggs in small quantities and then unites the products of his peregrinations and ships them to the agent of a central market. Many of these markets, in turn, make shipments to Paris. In the Central Halles of Paris the newly received eggs are at once examined by transparency. This operation is performed by a corporation of ninety-two examiners, with a foreman and several assistants. The function of these men, who are placed under oath, consists in examining the eggs in the cellars of the Halles, one by one, through the transparent light of a lamp, in order to separate the bad from the good ones. For counting and examining 1,000 eggs they receive 17 cents. It will be seen that the route followed by the egg from the farm to the market is not very direct. And yet, how much money would be made and how great services would be rendered, should small and large producers group their merchandise and send it directly and regularly to the large centers.



APPARATUS FOR CLASSIFYING EGGS.



APPARATUS FOR EXAMINING EGGS.

The benefits of co-operation applied to the egg trade appear in a striking manner in the results obtained in Denmark. The Danish producers have founded everywhere throughout the country co-operative associations that propose to furnish fresh eggs, of good quality, for exportation. The majority of the producers are enrolled therein. Regulations of remarkable ingenuity assure the regularity of the operation of such associations. For example, in order to ascertain by what member a bad egg has been delivered, it is required that the shell of every egg shall bear the name of the producer marked with a rubber stamp. Large numbers of depots are established near the railways, and to these every producer is obliged to bring his eggs at least three times a week. The deliveries at each depot are controlled by a special employe, who has the right to refuse eggs that are several days old. The others are classified according to their size. This double operation of examination and classification is effected automatically by means of a very ingenious apparatus, which consists of a dark chamber for the examination by transparency, and a long table provided with bars for the classification.

An endless, jointed, metallic belt carries the eggs in the first place into the dark chamber, where they are examined by means of a lamp, and then to the table, where they are classified. With this apparatus five girls can classify and pack 12 cases of 100 eggs in 13 minutes. The English have improved this machine by separating the examination from the classification. The first is effected in the box shown in the figure. The eggs, placed in a slightly inclined receptacle, enter cups jointed to the endless belt. This latter, in carrying them into the boxes, gives them a rotary motion. The belt is actuated by a small handwheel placed to the right of the examiner. To the left of the latter there is a drawer designed for the reception of the defective eggs. Owing to such an arrangement, the eggs are examined very rapidly.

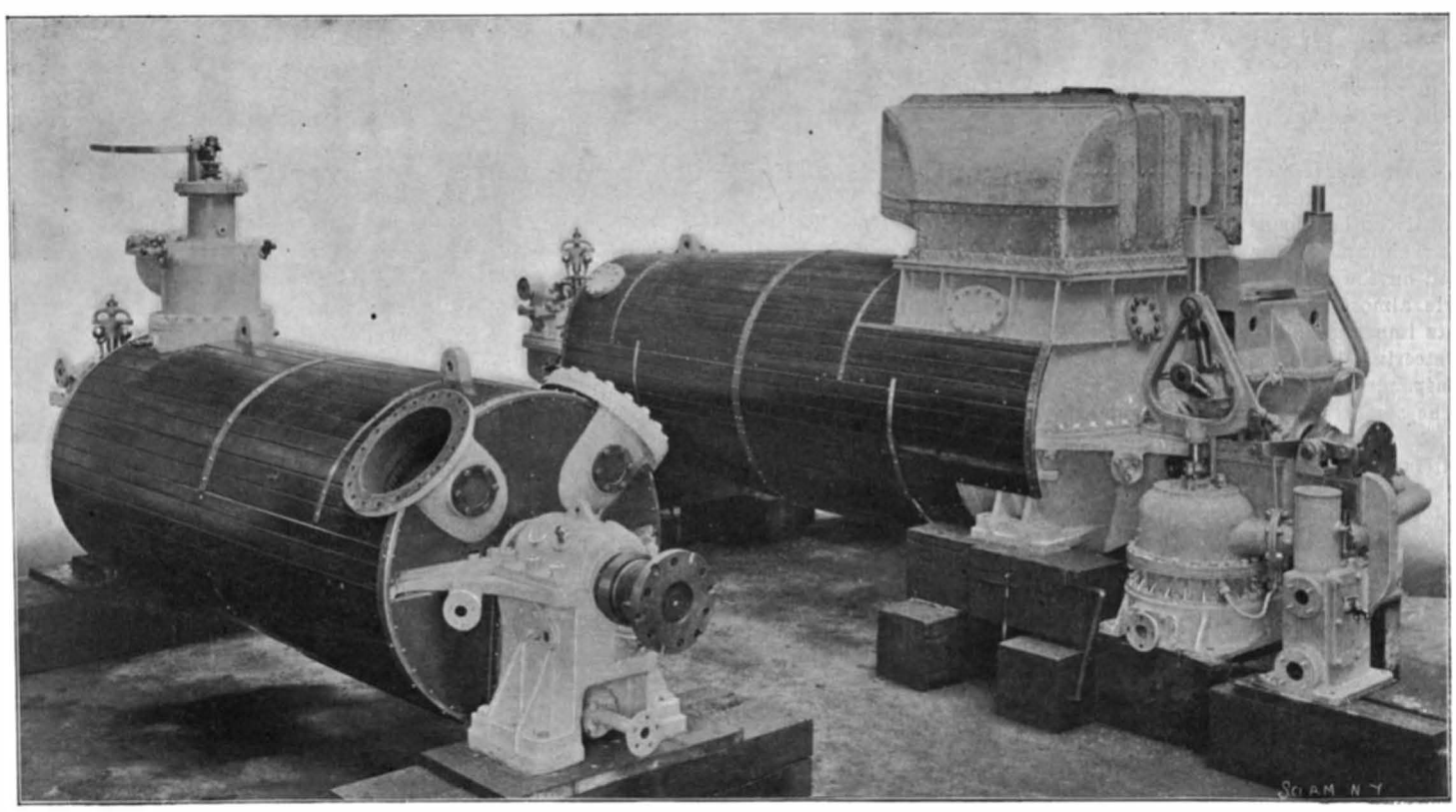
The operator, instead of examining the eggs one by one through the light, has merely to cast a glance at the rows that are passing over a lamp, in order to eliminate the bad ones and leave the others. The belt, continuing its motion, leaves the box with the examined eggs, and discharges the latter on the other side of a long inclined table.

The classifying apparatus is very simple. It consists of an inclined table, one of the extremities of which has a certain length of its surface covered with felt. It is here that the eggs are deposited, to be afterward slid over the glass surface of the table. The latter is provided here and there with parallel bars that arrest the different sized eggs upon their passage. The girls who slide the eggs over the table remove those that lodge between the bars and place them in special receptacles that flank each of these spaces. The manufacturers of the new apparatus claim that four girls can classify and pack with it 1,440 eggs in 10 minutes.

The Danish depositories provided with such apparatus are capable of rapidly and surely inspecting the eggs that are brought to them by producers and of shipping only fresh and perfect ones to London. They are, moreover, held responsible to the consumer and are heavily fined in case of shipment of defective eggs. The English highly appreciate the results of a so well-appointed organization. The Danish shipments to London are daily increasing, especially to the Aerated Bread Company, which has more than four hundred creamery establishments in the English capital.—For the above particulars and the engravings, we are indebted to La Nature.

THE TURBINE ENGINES OF THE "KING EDWARD."

The success of the turbine-propelled passenger steamer "King Edward," which on its trial trip achieved a speed of 20.5 knots an hour marks another step in the development of this most efficient form of steam motor. Although the practicability of driving a passenger ship successfully and economically by the steam turbine was a foregone conclusion in the minds of those who have any knowledge of naval architecture and steam engineering, it cannot be denied that the success of the "King Edward" will have an important effect in the great world



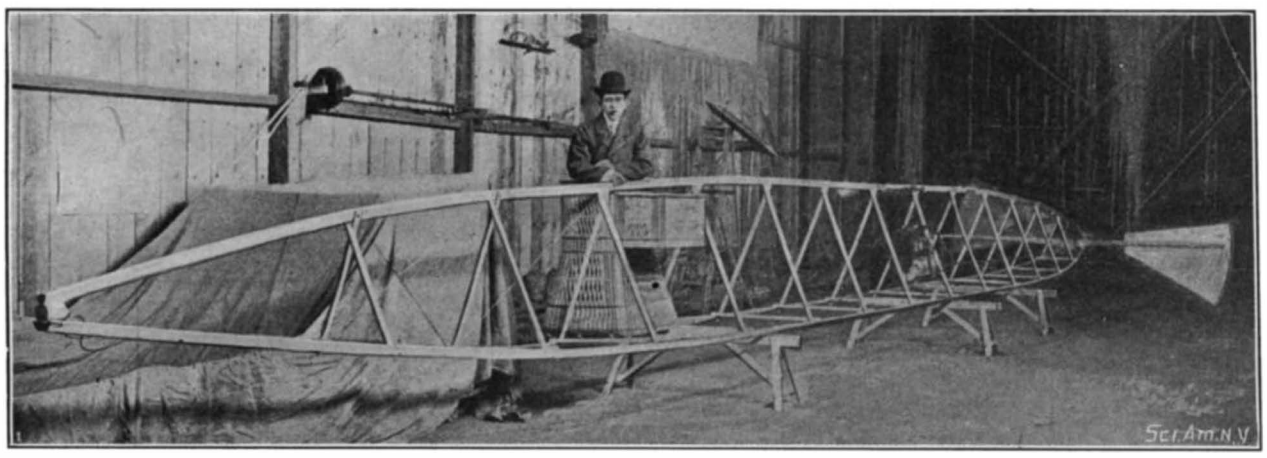
THE HIGH PRESSURE, AND ONE OF THE LOW PRESSURE TURBO-MOTORS OF THE "KING EDWARD."

of finance, which, after all, has the last word on the question as to whether an invention shall become a great commercial success.

Messrs. C. A. Parsons commenced the manufacture of steam turbines some sixteen years ago, and in the interim they have applied them with the greatest success as a steam-drive for electrical generators. At the present time the turbines installed in electrical work represent an aggregate of between 140,000 and 150,000 horse power.

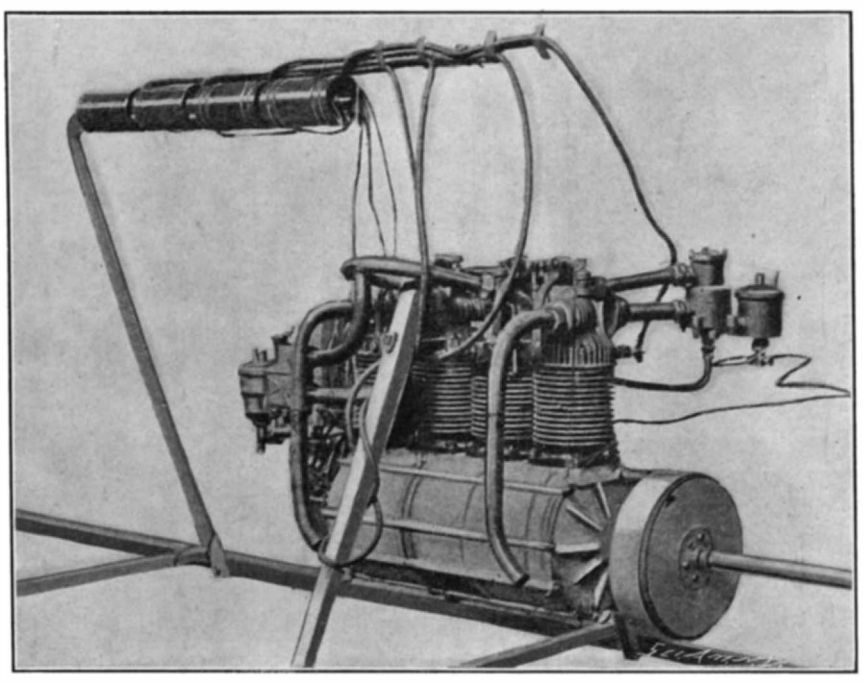
The successes achieved by the steam turbine ashore have been repeated afloat, the fastest steam-driven vessels in the world being propelled by Parsons' turbines. In 1897, the "Turbinia," a 40-ton yacht, made a speed on her trial trip of 34½ knots an hour, and later the "Viper," a 370-ton torpedo boat, maintained a mean speed of 36.58 knots an hour during a one-hour trial under English Admiralty conditions of weights and measurement. During these trials the "Viper" showed a coal consumption, per indicated horse power, which was within the guarantees of the contract. The economical operation shown by some of the larger turbines is truly extraordinary, and altogether surpasses the best results achieved by reciprocating engines. The largest size turbines yet constructed are two of 1,000 kilowatts output, built for the municipality of Elberfeld, Germany. During a test by Profs. Schroter and Weber, at an overload of 1,200 kilowatts, a full steam pressure of 130 pounds at the engine, and 10 deg. C. of superheat, the engine driving its own air pumps, the consumption of steam was ascertained to be at the rate of 18.8 pounds per kilowatt-hour. Comparing this result with the best results obtained with reciprocating engines, and taking the highest record of ratio of electrical output to the power indicated at the steam engine, namely 85 per cent, the figure of 18.8 pounds per kilowatt in the turbine plant is equivalent to a consumption of 11.9 pounds per indicated horse power per hour. Although such high efficiency is not to be expected in a marine plant, there is no doubt that the turbines of the "King Edward" will show a great advantage over marine engines of the same power.

As we have recently illustrated and described the "King Edward," we will merely reiterate her general features. She is 250 feet long, 30 feet wide, and her molded depth is 10 feet 6 inches to the main deck. The propelling machinery, of which we present photographic illustrations (the photographs being taken while the motors were in the erecting shop), consists of three steam turbines working compound. They are placed in the ship side by side, and each operates a separate shaft. The center is the high-pressure, and the two on the outside are the low-pressure turbines. Steam is admitted first to the high-pressure, where it is expanded five-fold. Then it enters the two low-pressure turbines, where it expands twenty-five-fold, the exhaust passing directly to the condensers. The total ratio of expansion, it will be seen, is 125-fold. In addition to the low-pressure turbines on the two outer or wing shafts, there are additional turbines, placed inside the exhaust ends of the low-pressure turbines, which are used in going astern. There are in all five propellers—one upon the center high-pressure turbine shaft, and two upon each of the outer low-pressure shafts, the outer shafts being used in going astern. The feed pumps are driven by separate engines, as are also the forced draft fan and the circulating pumps for the condenser. The main air pumps are worked by means of worm-gearing from the wing, or outer, shafts, the details of one of these pumps being shown very clearly in our illustration. In addition, there are auxiliary air pumps which are driven by the circulating pump engines. These are used for emptying the condensers of water when they are not in operation. The boilers are double-ended, of the return-tube type, with four furnaces at each end.



THE FRAME OF THE "SANTOS-DUMONT," SHOWING THE HELIX AND THE BASKET CAR.

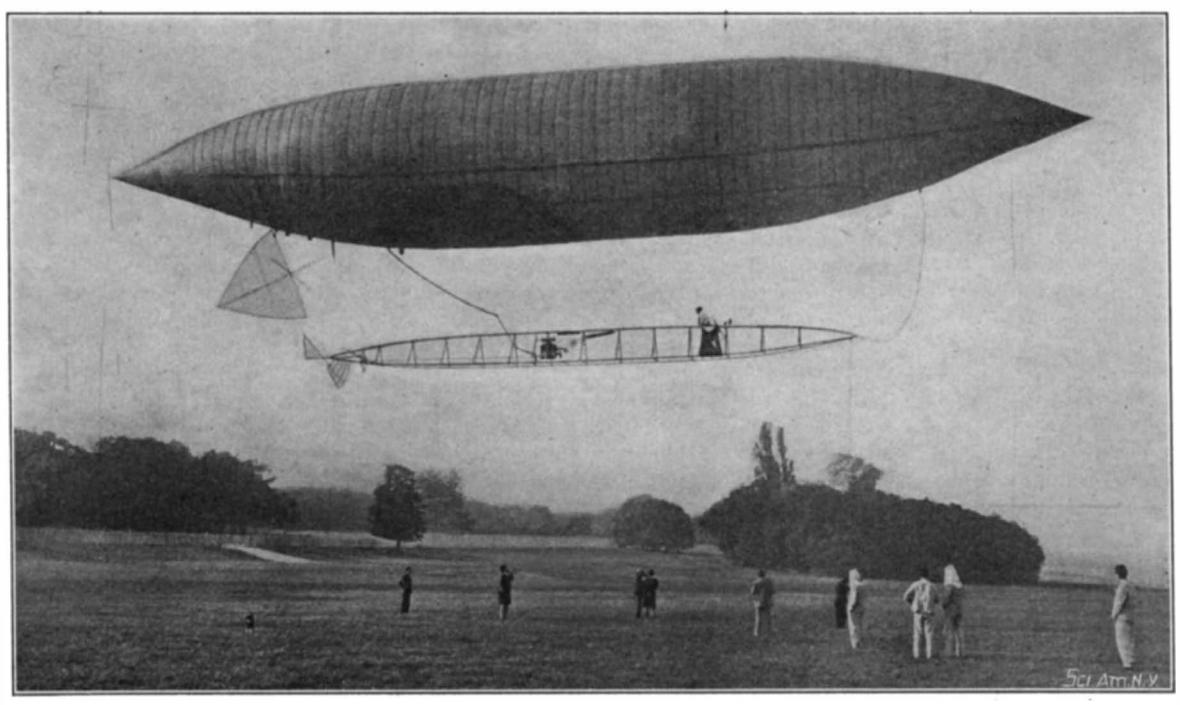
The motors, the condensers full of water, the steam pipes, the auxiliaries, the shaft, propellers, etc., weigh altogether 66 tons; and as the indicated horse power on the trial trip is estimated to have been 3,500, it will be seen that the engines compare favorably with engines of the standard reciprocating type. They are exceedingly light for the power they develop, the weight per indicated horse power being only about half that which is common to the engines of the paddle boats which are ordinarily used in the service for which the "King Edward" has been designed. On the trial of the "King Edward" on the Firth of Clyde, a speed of 20.5 knots an hour was registered as the mean of several runs over a measured mile. The mean revolutions were 740 per minute, the boiler pressure 150 pounds to the square inch, and vacuum 26½ inches, the pressure in the stokehole being equal to one inch of water. The new vessel is considerably faster than any of the river steamers of her class engaged in the same work, her speed exceeding that of her competitors by about one and a half knots per hour.



THE 16 HORSE POWER FOUR-CYLINDER SANTOS-DUMONT MOTOR.

THE SANTOS-DUMONT BALLOON.

The balloon of M. Santos-Dumont, which made a successful trip across Paris, as recorded in the SCIENTIFIC AMERICAN for July 27, is the fifth which he has built, and we are now enabled to give some detailed views of this remarkable airship. The balloon proper is cylindrical and is covered with silk, its extremities being pointed. It is 111 feet long, and its cubical capacity is 19,300 feet. Suspended by piano wire some 35 or 40 feet below the balloon is a light framework whose profile very much resembles that of the balloon proper. The framework is triangular in section, and is formed of three long pieces of wood, secured at the end and strengthened by cross-bracing and steel wires. This framework supports a four-cylinder, sixteen horse power motor of the Dion-Bouton type, the fuel reservoir, the shaft and the propeller. The engine is placed well toward one end, and the aeronaut rides in a light basket at the other end. Here he has under his control all of the machinery for maneuvering the balloon, also the ballast and the guide-ropes. The respective positions of the various weights were determined after many experiments, and its equilibrium is perfect. This assures its horizontality and an equal tension on the suspenders. This explains why the aeronaut is so far separated from his motor. The propeller, 14 feet in diameter, is composed of two vanes of wood and steel, covered with silk and highly varnished; it attains a speed of 150 turns a minute. The steering device is of silk and is placed between the balloon and the framework above the propeller. The balloon is inflated with hydrogen, and in order to maintain at all times a tension on the envelope—that is to say, perfect inflation—a compensating balloon filled with air is placed in the interior. This is inflated automatically, as required, by a small compressor actuated by the motor, the air being conducted to it by tubing. A guide-rope is suspended under the framework, and with its aid the necessary inclination is obtained to effect the movements of ascent and descent. Such, in brief, is the apparatus and method employed by M. Santos-Dumont. After his slight mishap on the day of his remarkable trip on the 13th of July, M. Santos-Dumont repaired the damage, and on July 29 he made another ascent. He had arranged to make his promised trip over Paris in the afternoon, but was obliged to abandon the idea, as he found that the motor was working badly. In order, however, not to disappoint the numerous visitors to St. Cloud, he gave a maneuvering exhibition over the Bois de Boulogne. Several ascents were made, and the guide-rope frequently caught in the trees, but it was released without any harm being done. The visitors were all astonished at the marvelous control the inventor had over the balloon. The motor is still giving him trouble, and on his last trip the screw was frequently at a standstill. The balloon's great size and the absence of landing platforms help to make the ascents and descents diffi-



ASCENT OF THE SANTOS-DUMONT DIRIGIBLE BALLOON NO. 5 AT LONGCHAMPS ON JULY 12.

cult. For our engravings we are indebted to L'Illustration.

Osmium Filament and Lamp.

M. Auer von Welsbach has found a method of making incandescent lamp filaments of osmium, and the new lamp presents decided advantages. The incandescent lamp is more economical the higher the temperature at which the filament burns, and as osmium is the metal which has the highest fusing point, it is found that it can be burned at a higher temperature than the carbon filament, with consequent economy of energy. Although osmium has usually been recognized as a pulverulent or spongy body, or again in its hard form, the inventor has succeeded in making filaments of it, and the new lamp is receiving considerable attention. It not only gives more light for a given consumption of energy, but its life is said to be greater than that of the carbon filament; the osmium lamp takes 1.5 watts per candle power and lasts 600 hours, even reaching as high as 1,000 to 1,200 hours. When the bulb has become darkened on account of the deposit, it may be cleaned easily and cheaply without having to change the filament or bulb. On account of the lower electrical resistance of the osmium filament the lamps are burned at a lower voltage than for carbon filaments; they are made at present for tensions of 20 to 50 volts. On an alternating current system this voltage is easily obtained by the use of the proper transformers. Another advantage of this low voltage is found in its use with accumulators, as a less number of cells are required; on account of the diminished weight the system promises to be valuable for vehicle and railroad lighting. According to the experiments carried out by M. Scholz, the lamp has an economy of 60 per cent over the present lamp. It is said that the lamp is already being made in capacities from 5 to 200 candle power.

An accident recently occurred in the power station of the Edison Electric Illuminating Company, Duane Street, New York city. The comments of the daily papers upon the accident are amusing. The following are some examples: "Like a sharp clap of thunder and with a flash of blue flame the huge 12-foot rotary high-tension converter of the Edison Electric Illuminating Company, making thousands of revolutions a minute, exploded early last night, scattering tons of iron and copper all over the place." Another paper said: "Electric flames poured through the gate on Duane Street and shot up the front of the building." Still another said: "The wheel, weighing more than five tons and 12 feet in diameter, went to pieces without a second's warning, splitting into thousands of fragments." The following is equally interesting: "Fifty men fled for their lives when the rotary of one of the high-tension converters burst."

The Building Edition for August.

The Scientific American Building Edition for August is an extremely beautiful number of this interesting and elaborately illustrated periodical. The residence of Claus Spreckels, at San Francisco, and the house of the Hon. William C. Whitney, in New York, are both illustrated and described. Several interiors of the Spanish-American missions are also shown. The houses selected for this issue are charming, and there are a number of views of interiors. The editorial is entitled "The House and the Home." The monthly comment contains many remarks pertinent to houses. The talk with architects this month is given by Mr. Walter Cook on "The Large City House." The column of "Household Notes" is a new and interesting feature. Those who have not seen the Building Edition in the last few months should purchase a copy of the August number.

The Current Supplement.

The current Supplement, No. 1336, is opened by a large engraving showing M. Santos-Dumont navigating his balloon. "Household Tests for the Detection of Oleomargarine and Renovated Butter" is by G. E. Patrick, Department of Agriculture. "Marketing and Preserving Eggs" is a most elaborate treatment of the subject. "The German Colony of Togo" is accompanied by eight illustrations. "Some Advances Made in Astronomical Science During the Nineteenth Century" is by C. L. Doolittle. "The Series Alternating System" describes some interesting transformers.

A New Kind of Gas Tubing.

A new kind of gas tubing is put on the market, which is recommended for use where there is any risk of the rubber being burnt, as in gas cooking stoves, ironing, chemical works, etc. The rubber tubing is covered with finely woven braid of asbestos, and further with incombustible paint, which will withstand a great amount of heat. Numerous accidents occur through the tubing coming in contact with the gas flame, or with heated materials, and this new article, showing decided advantages over ordinary rubber tubing, should command a ready sale.

A NEW FORM OF BAROMETER.

BY EDWARD COLERIDGE ROBERTS.

When barometers are constructed for absolute measurements it is necessary that the vacuum be as good as may be, perfect if possible, in order that wide differences of temperature may not alter the readings except through the expansion of the mercury, and that its reading may correspond with that of other standard barometers. Where the barometer is used merely as a weather glass, however, different conditions obtain. Here, as the instrument will probably be kept indoors, the temperature will vary but little between two readings, or even through the year. The total variation is not more than 20 degrees F. indoors, and not more than 10 degrees F. from day to day. Therefore no serious error will be introduced in the position of the mercury column under different air pressures, even if the tube be not boiled out.

When any one undertakes to build for himself a barometer, and is, as many of us are, more blessed with manipulative skill than with this world's goods, the following form possesses points of interest.

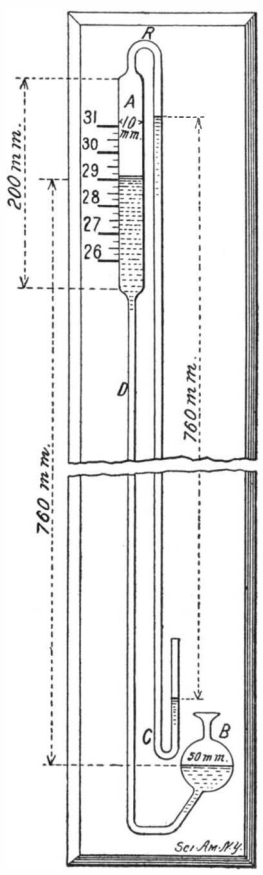
In building a barometer such a person will pay attention to the following points:

1. The necessary amount of mercury should be as small as possible.

2. Both mercury surfaces should be large, the upper being not less than 1 centimeter in diameter, and the lower about 4 or 5 centimeters.

3. The construction should permit of easy filling, to facilitate transportation.

These conditions are all met in the form of instrument shown in the drawing. The tube, *A*, 1 by 20 centimeters, is sealed at both ends to a thermometer tube whose internal diameter is about 1 millimeter. This tube is then bent as shown, and to the end of the length, *D*, is sealed the bulb, *B*, whose diameter is about 5 centimeters. In bending the tube care must be taken that the dimensions given on the drawing are carefuly adhered to. The whole tube must then be carefully cleaned with nitric acid, and is then washed in succession with distilled water, alcohol, ether, and dry air. It is then attached to a suitable frame, and is ready to be filled with mercury.



The particular form of the tube makes filling a very simple matter. Sufficient mercury is poured into the bulb, *B*, to a little more than half fill it. The whole thing is then laid on edge with the bulb, *B*, up. The mercury will then flow around through the whole tube, driving the air out before it through the tube, *C*. When the whole is filled, the barometer is quickly turned up on end again. Now the distance from *R* to the surface of the mercury at either *B* or *C* is more than 30 inches, and consequently the column breaks at *R* and settles down till on each side it is 30 inches high. Here we have practically two barometers in parallel, the one, *C*, acting in this case merely as an airtight seal to the top of the tube of the other. The advantages of the construction are these:

1. The effective diameter of the tube is the same as that of the part, *A*, while the amount of mercury contained in the apparatus is reduced by about one-half.

2. The impossibility of filling a tube like this were it sealed off at *R* is obviated by the addition of the part, *C*, which permits of the easy expulsion of the air, and then forms a seal to prevent its re-entrance.

A barometer has been constructed on these lines, and has been in use for the last six months. The closeness of its readings to those of a Bortin barometer show that little, if any, air is present in the tube.

Its construction occupied about a day and a half, most of which was spent on the glass blowing, as the writer was not extremely proficient at that art. The work could be repeated in a much shorter time. If this short description shall be of encouragement to any would-be observer of the barometer, I shall feel that the time spent in the construction of the instrument has by no means been wasted.

Ithaca, N. Y.

The construction of cement houses is under consideration at Pittsburg. Vast quantities of furnace slag are produced each year which might thus be utilized.

THE NEW BATTLESHIP DESIGN CONTROVERSY.

When Lieut. Strauss several years ago drew up his design for the double-decked turret, it is probable that he little imagined that he was opening the way for a storm of controversy, the like of which, surely, has never been seen in the bureaus of our navy. From the very first the new device met with vigorous opposition, some of which was due to the distrust which a radical innovation inevitably arouses, while most of it was due to considerations of a more or less technical character. On the other hand, the military and tactical advantages of the double turret were so obvious that it was bound to secure a large following, particularly among the line officers, to whom the great concentration of fire secured by the system was naturally very attractive.

The subject was well threshed out when the designs of the "Kentucky" and "Kearsarge" were under consideration. It was again up for earnest and lengthy discussion when the designs of the "California" and "Virginia" type were being drawn up, and it now dominates the discussion of the Naval Board of Construction, who are engaged in planning the new battleships authorized by our last Congress. Two radically different types of ship, or, to be more correct, two types with radically different batteries, are proposed, one drawn up by Rear-Admirals Bowles, O'Neil and Melville, and the other embodying the latest ideas of the advocates of the double turret, as presented and strongly advocated by Rear-Admiral Bradford and Captain Sigsbee.

We present a sheer plan and deck plan of each design, together with a diagram showing the maximum concentration of fire possible from the intermediate and secondary batteries of each vessel. The 12-inch guns are not included, for the reason that they are common to both designs. The type of battleship approved by Admirals Bowles, Melville and O'Neil has the following general dimensions: Length, 450 feet; beam, 76 feet; mean draft, 24 feet 6 inches; displacement, 15,560 tons. The total displacement, with everything on board and full bunkers, will be 16,900 tons, and the draft at the greatest displacement will be 26 feet 4 inches. The vessel is to have a speed of 19 knots, with an indicated horse power of 20,000. The battery will consist of four 12-inch guns in two turrets protected by 10-inch armor, twenty 7-inch rapid-fire guns protected by 7-inch armor, and twenty 3-inch rapid-firers behind 2-inch armor. The 12-inch guns will be carried in pairs in fore and aft turrets on the main deck. On the same deck four 7-inch guns will be mounted at the four corners of a main deck battery. They will be completely inclosed by a semi-circular wall of 2½-inch armor, which will connect with an outside wall of 7-inch armor, forming an inclosed casemate. On the gun deck below there will be sixteen 7-inch guns carried in broadside. These will be protected in front by a complete wall of 7-inch armor. The four guns at the corners of the battery will be entirely inclosed by a wall of 2½-inch armor at the rear, the protection being similar to that of the four 7-inch guns on the deck above. The twelve other 7-inch guns on the gun deck will be protected from the effects of shells bursting between decks by transverse walls of 2½-inch armor, which will extend across the gun deck between each pair of guns, there being thus two guns between each inclosed section. The twenty 3-inch guns will be disposed as follows: Fourteen on the main deck, protected by 2-inch armor, and six similarly protected on the gun deck. Of the 3-inch battery on the main deck, two guns will be carried at each corner of the central battery, and six will be carried, three on each broadside, between the 7-inch guns of this battery. Of the six 3-inch guns on the gun deck, two will be carried forward, one on each beam, and four astern. The concentration of fire ahead will be two 12-inch, four 7-inch and six 3-inch, while astern it will be possible to concentrate two 12-inch, four 7-inch and eight 3-inch guns. On either broadside the concentration will be four 12-inch, ten 7-inch and ten 3-inch.

It will be seen that in this design the 8-inch gun and double turret are entirely eliminated. The 7-inch gun is adopted in place of the 8-inch for the reason that the former exceeds the latter in range, flatness of trajectory and rapidity of fire. It will also weigh considerably less per total energy of fire delivered in a certain time. The double turret is thrown out on both tactical and structural grounds. Tactically, it is considered to be subject to the grave disadvantage that one man is responsible for the training of all four guns and that independent aiming is therefore impossible. Admiral Bowles uses the homely, but very apt, simile of one sportsman armed with a four-barreled shotgun and four men each armed with a single-barreled shotgun, and suggests the obvious inference that four men would be likely to make a better bag than the single sportsman. The majority of the Board also consider that the superposed turret has the objection that a single, well-placed shot from a heavy gun might throw two 12-inch and four 8-inch guns, or one-third of the main battery, out of action.

We might add that a machinist's wrench, or a small screw-bolt carelessly dropped into the rotating mechanism might just as easily accomplish the same result. On structural grounds, it is urged that there is a complication of mechanism, with its consequent extra liability to disarrangement. It is also pointed out that a comparison of the results obtained in the battle of Manila by the 8-inch guns mounted in turrets and those mounted behind shields, shows that the 8-inch guns mounted in the open gave greater rapidity of fire than the 8-inch turret guns of the "Olympia." It is also urged that at Santiago only thirteen hits were made by the 319 shells fired from 8-inch guns carried mainly in turrets by the ships engaged in that action. The majority report also states that although the minority ship with its twelve 8-inch and twelve 6-inch guns will throw 4,500 pounds of metal in one minute from one broadside, as against 4,125 pounds of metal in a minute from the broadside of the majority type, the former will only throw 3,300 pounds of metal from the other broadside, whereas the majority type can throw the same amount of broadside metal from each broadside at the same time. Again, all the guns, except the 12-inch, of the Bowles type, will together throw 8,250 pounds of metal a minute against a maximum of 7,800 pounds of metal a minute thrown by the design of Admiral Bradford.

The report to the Department by Rear-Admiral Bradford very ably presents the advantages of type recommended by the minority of the Board. The strength of the argument lies chiefly in the superior offensive power presented by the use of the 8-inch gun and the double turret. The accompanying diagrams of the vessels showing the concentration of fire are reproduced from this report. The minority design differs from the one just described mainly in its battery. It carries two superposed turrets, one forward and one aft, each of which contains two 12-inch and two 8-inch guns. In addition there are eight 8-inch guns contained in four turrets arranged on the quadrilateral system, as seen on the "Oregon" and her class. There are also twelve 6-inch guns carried in broadside on the gun deck, and eight 3-inch guns carried, four on the main deck, and four on the gun deck. In the two diagrams showing energy and range of fire, the full black lines show the total number of guns of various calibers that can be concentrated over a given arc of fire. The outer circle which is shaded in dotted lines, shows the total energy of fire that can be concentrated over a given arc of fire by all the guns in each ship exclusive of the 12-inch. The figures printed in the shaded portions represent the combined muzzle energy in foot-tons. Rear-Admiral Bradford draws attention to the fact, as shown in these diagrams, that the maximum broadside fire of the 7-inch battery, with a muzzle energy of 230,620 foot-tons, extends over an arc of only sixty-four degrees, while in the other type the maximum broadside fire extends over an arc of ninety degrees, with a muzzle energy of 253,174 foot-tons, both vessels being supposed to be engaged on one side only. It is also pointed out that the average muzzle energy per minute throughout the entire arc of fire is 158,619 foot-tons for the Bowles type of ship, as against 190,120 foot-tons with the Bradford type, when engaged on one side only, and 173,760 foot-tons when engaged on both sides. The report states that naval tacticians are agreed that engagements in the future will present few instances of a single ship being engaged on both sides at one time. The firing diagrams are based upon the following assumed rates of fire per minute: 8-inch guns 1.2 rounds; 7-inch guns, 2.5 rounds, and the 6-inch guns 3.5 rounds. At these rates of fire the muzzle energy, per minute, would be 16,322 foot-tons for the 8-inch; 23,062 foot-tons for the 7-inch; 20,433 foot-tons for the 6-inch. Rear-Admiral Bradford gives reasons for his belief that in this table the 7-inch gun has been highly favored, the chief of which is that the time required for loading the two guns, 7-inch and 8-inch, will be very nearly the same. He also considers that the shaded area in the energy-of-fire diagrams shows that his type of battleship will have a great tactical advantage over the type advocated by the majority.

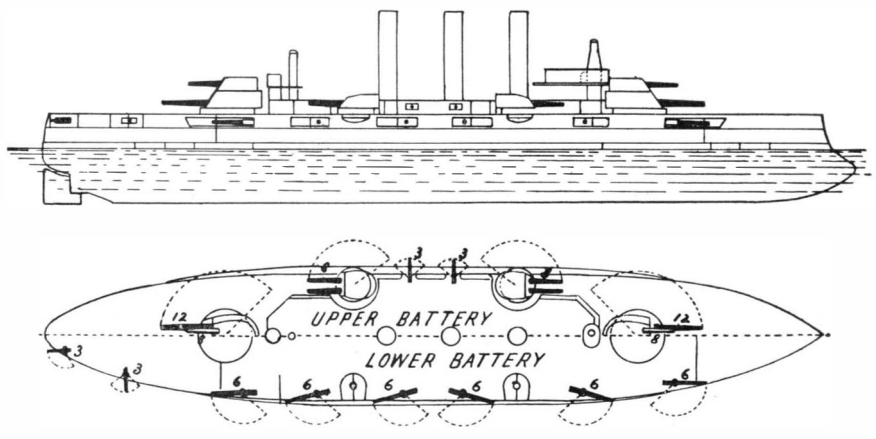
Further argument in favor of this type is drawn from the fact that although the English have so long confined themselves to two calibers of guns, the 12-inch and 6-inch, their latest designs call for intermediate calibers of 7.5-inch and 9.2-inch in the armament of their battleships. Rear-Admiral Bradford believes that he is also supported in his strong advocacy of the turret system of mounting, by the present trend of design in foreign navies. He points to the fact that the navies of France, Russia, Germany and Italy show a desire, in all their later designs, to isolate all guns by placing them either in turrets or casemates, and usually in pairs. This desire is to be attributed to the enormously destructive effect of high-explosive shells when bursting within the armor protection, an effect to which Admiral Bradford considers that the majority type of ship, with its large number of guns placed in broadside, will be particularly liable. Further argument in favor of isolation within turrets is drawn from the report recently issued of the destructive effect of high-explosive shells on the guns and dummy gun crews of the British battleship "Belleisle," which was subjected last year to attack by an English first-class battleship.

We are free to confess that the arguments on this score do not seem to us to apply with any weight to the majority design, for the reason that the 2½-inch transverse screens and the rear walls of casemates, would be sufficient to localize the destructive effects which are quoted at such length in the minority report.

While Rear-Admiral Bradford concurs with the majority of the Board as to the general type of ship recommended as far as displacement, speed, coal endurance, etc., are concerned, he admits that the type recommended by him calls for about 300 tons greater displacement than the type advocated by the majority. Although with this addition the full load displacement would be brought up to about 17,200 tons, the report points to the fact that the British government is already laying down battleships of 18,000 tons displacement.

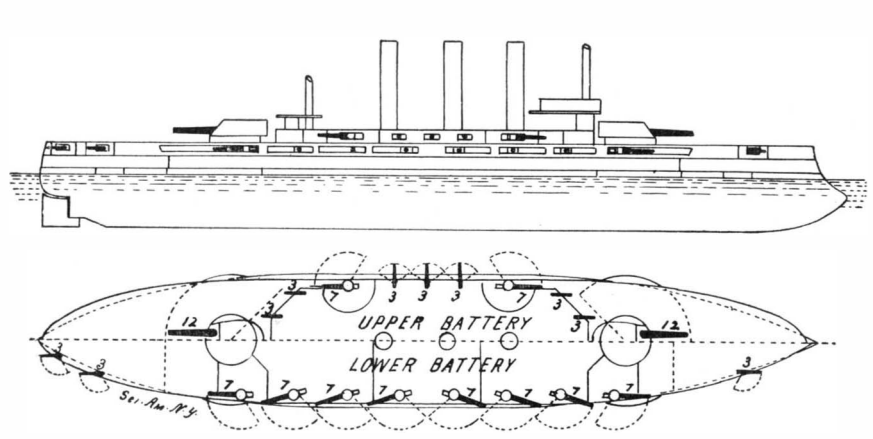
We have now, as far as our limited space will allow, presented to our readers the two sides of this controversy, in which, broadly speaking, the judgment of the men who design and construct our warships, with their engines, armor and guns, is directly at variance with that of the men whose duty it is to handle them and fight them on the high seas.

At first sight it would seem to be a case of theory against practice; but as a matter of fact, on considering the two reports, it will be seen that the arguments are mainly theoretical on both sides. And so they are likely to remain, until a test of actual conflict occurs between opposite types fought by equally skilled crews of equal determination and endurance.



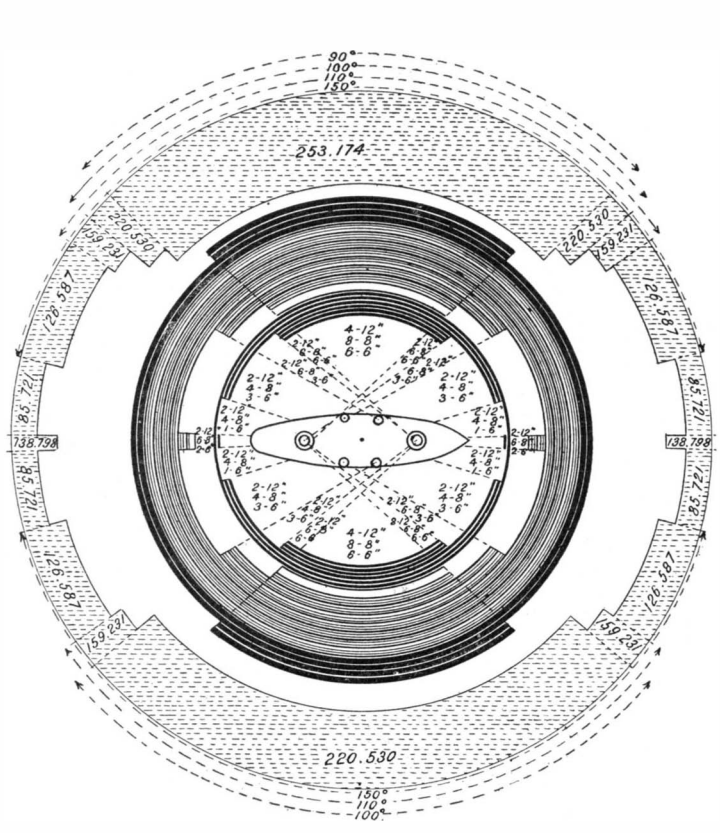
MINORITY DESIGN.

Main Battery; four 12-inch, twelve 8-inch, twelve 6-inch. Secondary Battery: eight 3-inch.

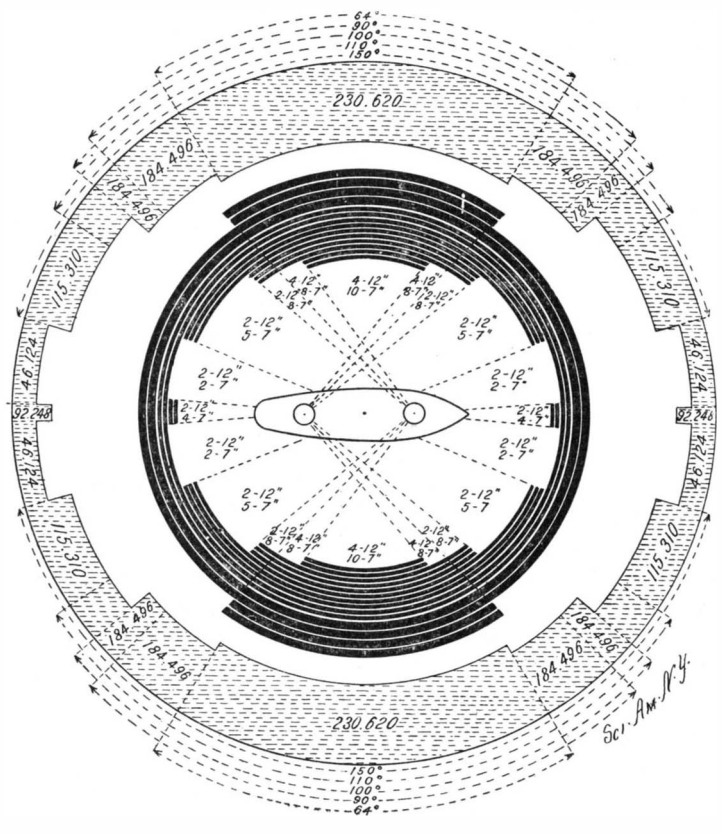


ACCEPTED DESIGN.

Main Battery: four 12-inch, twenty 7-inch. Secondary Battery: twenty 3-inch.



TYPE RECOMMENDED BY MINORITY REPORT.



TYPE ADOPTED BY THE NAVAL BOARD ON CONSTRUCTION.

Diagrams show by full black lines arc of training of all guns. The shaded sections show maximum muzzle energy in foot-tons per minute of all guns except the 12-inch.

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RECENTLY PATENTED INVENTIONS.

Mechanical Devices.

ORE WASHER AND SEPARATOR.—Henry P. Holden, Washington, D. C. This apparatus, which is intended for use in placer mining, is designed for treating the ores in large quantities. The invention embodies various novel features by which to increase the capacity of such apparatus. The improvements relate to the construction and arrangement of the different parts of the apparatus, including the riddle, screen and hopper, as well as to the rake, which is counterbalanced and operated in one direction by a suspended weight.

BAND-SAW MILL ATTACHMENT.—Zebulon Z. Linton, Fernwood, Miss. This attachment relates to feed-out devices, and embodies novel features to the end that springy timber will be prevented from clamping the band-saw, and the timber will be held in proper alignment as it passes from the saw, so as to insure uniform and straight lumber. A spring-seated kerf-guide yielding laterally to heavy pressure allows springy timber to follow the proper course.

OIL-CAN.—William L. Howland, Monmouth, Ill. This oil-can has a piston pump attached to force out the oil in an ample, steady stream. The can spout at its inner end enters the lower end of the pump cylinder, and a single valve controls the inlet to the cylinder and the outlet to the spout.

Agricultural Implements.

DRAFT EQUALIZER.—Henry Carpenter, Edmond, Oklahoma. The distinguishing feature of this equalizer is a bar called by the inventor a "pusher bar," which is pivoted to the evener and ranges rearwardly in a diagonal direction against the tongue, connections being provided for effecting, through the medium of the pusher bar, an equalization of the draft of two, three or more horses.

HARVESTER REEL.—Edward O. Beckman, Piper City, Ill. This inventor has devised a reel in which the blades are connected with the shaft by parallel connecting bars so that the parts fold after the manner of a parallel ruler. Adjusting bars connect with the blades and with a sliding collar on the shaft. The reel is adapted to be easily detached and to be folded into small compass, for economizing shed space.

Wagons and Harness.

VEHICLE RUNNING GEAR.—John E. York, inventor. The purpose of the running gear devised by this inventor is to prevent side lash on the pole and to enable the wheels to readily surmount stones or like obstructions. The front wheels are mounted on stub axles formed centrally on spider-frames, two vertically aligned arms of which are pivoted to the axle, the remaining two arms of the spider being pivoted to transverse links which connect the spiders at opposite ends of the axle. The invention, we understand, has proved advantageous on wagons bearing heavy loads. Particulars may be had from George M. Pillsbury, Lowell, Washington.

HORSE-COLLAR FASTENER.—John H. Emerson, Quincy, Ill. In this ingenious collar fastener, the connecting billet at the meeting ends of the collar is fastened at one end by a buckle, by which the necessary adjustment to the neck of the animal is obtained, and this adjustment is not again disturbed in removing or placing the collar. To the opposite end of the billet is secured a slotted plate and a stay strap. The plate is slipped over a staple on the collar and the stay strap passed through the staple. Thus the collar may be quickly placed on the animal or removed without disturbing the buckle connection.

Household and Culinary Devices.

LID HOLDER FOR VESSELS.—Benjamin F. Koch, Brooklyn, New York city, and John W. Cogswell, Hoboken, N. J. The device forming the subject of this patent is designed to hold the lid on a cooking vessel while pouring liquid contents therefrom. The holder is in the shape of a frame with hooks for engaging the flange of the vessel, finger-pieces for engaging and releasing the hooks, a spring for normally holding the hooks engaged, and a handle portion to aid in tilting the vessel.

FRAME FOR MOSQUITO CANOPIES.—Lottman Brothers Manufacturing Company, Houston, Tex. The latest patented improvement in the very useful canopy frames of this company is ingeniously and simply constructed of wire and in a manner to give the side-arms the form of braced cantilevers with the strength to maintain the canopy frame in the proper position and sustain it against downward strain.

BROILER.—Adrien Tenu, Manhattan, New York city. In the ordinary broiling devices that are adapted to contain a charcoal or like fire, and used, by hotels largely, in lieu of broiling over ranges or the like, the fire is very destructive on the broiling grate, and the inventor mentioned has provided for lessening this destructive action by arranging a sliding grate, and the casing is arranged so that the hot coals may be raked under the grate in one position, while when not in use the grate is not subjected to the intense heat of the coals.

SCRUBBER.—Mary N. Van Derbeck, Lincoln, Neb. A unique scrubbing device has been patented by this inventor, whereby an ordinary scrubbing brush is clamped in a head having a pivoted handle and a wheel or roller to run on the floor at the rear of the clamping head. The roller serves to hold the brush level as the device is forced over the floor, and also bears a part of the thrust incident to the manipulation of the device.

Miscellaneous Inventions.

CARVING OR DELINEATION MACHINE.—Arthur C. Féron, Manhattan, New York city. In this machine a tracer traverses and follows the lines of a drawing or model, and a pencil or carving tool reproduces the lines followed by the tracer, but in a reverse position. The invention provides a most useful instrument where a plurality of figures of the same kind are to be reproduced and it is necessary to first reproduce from an original a reversed design and then use this as a pattern. In the Féron devices there is a central elongated guideway, suspended as from a ceiling, and from a central pivot moving in the guideway, arms project at opposite sides and carry the tracer and the pencil or rotating carving tool, novel links and braces being provided to project like the main arms, on opposite sides from pivots traveling in the guideway.

BOOK HOLDER AND LEAF TURNER.—Clark W. Hadlock, Newton, Kans. This invention is especially intended for use by railway conductors, more particularly on freight trains, where frequent turning of the leaves in both directions is necessary in making up the complicated record of freight. The frame is adapted to secure the train book on the usual writing board, and so that the board can be held on the conductor's arm unaffected by the motion of the car and the leaves be readily turned as required.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

THE MEASUREMENT OF GENERAL EXCHANGE VALUE. By Correa Moylan Walsh. New York: The Macmillan Co. 1901. 8vo. Pp. 580. Price $3.

The author deals with the Nature of Exchange Values, the Correlation of Exchange Values, on the Measurement of General Exchange Values, Selection and Arrangement of Particular Exchange Values, Mathematical Formulation of Exchange Value Relations, the Question of the Means and Averages, Brief Comparison of the Means, the General Argument for the Geometric Means, Review of the Arguments for the Harmonic and Arithmetic Averages of Price Valuation, the Method for Constant Sums of Money, the Method for Constant Mass-Quantities, the Universal Method, the Doctrine of the Conservation of Exchange Value and the Measurement of Exchange Value in All Things, and, lastly, the Utility of Measuring the Variations in Exchange Value of Money. The author uses mathematics freely, and the book will prove interesting to political economists.

HAND BOOK OF PRACTICAL MECHANICS FOR USE IN THE SHOP AND DRAFTING ROOM. By Charles H. Saunders, Ph. D. Boston, Mass. 1901. 16mo. Pp. 227. Price $1.

A full index gives a clew by which any of the tables and formulæ can be found. The tables are particularly valuable. The book varies greatly in typographical excellence. Many of the tables seem to have been prepared by photo-engraving. The book will prove of real assistance to mechanics and engineers in their everyday work.

LES AUTOMOBILES ELECTRIQUES. Par Gaston Sencier and A. Delasalle. Avec un préface de Charles Jeantaud. Paris: Vve. Ch. Dunod. 1901. Pp. 390.

The authors have produced a work on electromobiles, which, without being too technical, describes various forms of electric carriages and trucks with an exhaustiveness that will be appreciated, particularly by the makers of electric carriages. It is to be regretted, however, that the admirable printing of the work is somewhat marred by cuts which are not often very clear. The book is to be welcomed, on the whole, as a valuable addition to the literature of the automobile. Particularly interesting is the chapter dealing with the various types of storage batteries.

LA SÉRIE DE TAYLOR ET SON PROLONGEMENT ANALYTIQUE. Par J. Hadamard. Paris: C. Naud. 1901. 16mo. Pp. 102. Price 50 cents.

PRODUCTION ET EMPLOI DES COURANTS ALTERNATIFS. Par L. Barbillon. Paris: C. Naud. 1901. 16mo. Pp. 103. Price 50 cents.

We have frequently had occasion to comment upon the admirable series of "Scientia" monographs published by Carré and Naud. The present two volumes maintain the high standard set by the previous works. The new light thrown by M. Hadamard on Taylor's formula will do much to illuminate a difficult mathematical problem. His work is scholarly, and for the mathematician decidedly interesting.

Dr. Barbillon's book is written for the electrical engineer, and is devoted to a mathematical discussion of alternating currents, which is thorough and scientific.

Business and Personal Wants.

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Inquiry No. 1143.—For manufacturers of corrugated steel diaphragms for use in ammonia pressure reducing valve.

SAWMILLS.—With variable friction feed. Send for Catalogue B. Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 1144.—For parties in Canada to manufacture grafite boxes.

Machinery designed and constructed. Gear cutting. The Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 1145.—For parties dealing in heavy hydraulic tubing for hollow shafting. The size to be 3¼ inches outside diameter, walls ½ inch or 5/8 inch thick, to turn down to 3 inches diameter.

See our Collective Exhibit—Section "S," Electricity Building, Pan American Exposition. Standard Welding Company, Cleveland, Ohio.

Inquiry No. 1146.—For manufacturers in Canada of large toys, wagons, stepladders, etc.

To Patentees. Wanted to manufacture article which will retail to lady consumers for about $1.00 leaving good margin of profit.—C. S. O, Box 773, N. Y.

Inquiry No. 1147.—For manufacturers of saw benches for sawing sheet brass and copper.

FOR SALE.—New process for making oil with fish and fish offal is offered for sale or licenses in United States of America. Address Foreign, Box 773, New York.

Inquiry No. 1148.—For manufacturers of electric shoe polishing apparatus.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 1149.—For manufacturers of balloons.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 1150.—For manufacturers of novelties in Canada.

WANTED.—A thoroughly competent engineer to push in United States of America a new, efficient and economical process, for dealing with large benefit towns' sewage and refuse waters from industry. Address France, Box 773, New York.

Inquiry No. 1151.—For dealers in roots and herbs.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Inquiry No. 1152.—For parties to make special machinery for weaving wire fences.

WANTED.—Punch and die work, press work and light manuf'g. Daugherty Novelty Works, Kittanning, Pa.

Inquiry No. 1153.—For manufacturers of flagstaffs for small toy flags.

WANTED.—Souvenirs, premium goods, toys and Christmas novelties. Sherman, Arch Co., 142 Merrimac Street, Boston, Mass.

Inquiry No. 1154.—For manufacturers of wood for the frame of box kites.

Inquiry No. 1155.—For manufacturers or dealers in Spanish tile roofing.

Inquiry No. 1156.—For a bag fastener known as the "Boss Fastener."

Inquiry No. 1157.—For manufacturers of machinery for making cardboard pie plates, butter dishes etc.

Inquiry No. 1158.—For manufacturers of gas engines in New York City.

Inquiry No. 1159.—For manufacturers of machines for making wooden pegs for shoes.

Inquiry No. 1160.—For manufacturers of ice machines.

Inquiry No. 1161.—For manufacturers of electric dynamos.

Inquiry No. 1162.—For address of parties having Swedish anvils for sale.

Inquiry No. 1163.—For dealers in second-hand turning lathes and drill presses in Chicago, if possible.

Inquiry No. 1164.—For manufacturers of a condenser ¼ to 1 microfarad capacity.

Inquiry No. 1165.—For manufacturers of air pumps and compressors.

Inquiry No. 1166.—For dealers in elevating machinery for elevating grain and feed, and machinery for cleaning oats.

Inquiry No. 1167.—For manufacturers of electrical heating apparatus.

Inquiry No. 1168.—For manufacturers of models of locomotives made of cardboard.

Inquiry No. 1169.—For manufacturers of coffee roasters of about 150 pounds capacity and a cooler for same.

Inquiry No. 1170.—For the present address of the Farmers' Handy Wagon Company.

Inquiry No. 1171.—For manufacturers in the United States of a mechanical apparatus used for loading coal inside the pits.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(8295) P. C. T. writes: I would like instructions for making a simple, very cheap and easily made galvanometer for measuring currents from 1 to 4 Leclanche cells if you have papers having such instructions. A. We have no paper giving instructions for just the instrument you require. SUPPLEMENT No. 1215, price 10 cents, gives a voltmeter and an ammeter which you might modify to your needs. Bottone's "Electrical Instrument Making for Amateurs," price 50 cents by mail, contains descriptions of these instruments as well as many others.

(8296) C. P. R. asks: May I trespass on your valuable time with a query with hope of answer? It was recently stated that at Bahrein, on the southwest coast of Persia, on the Persian Gulf, the natives obtain their supply of fresh water from springs at the bottom of the Gulf more than a mile from shore, and that divers go down 200 feet, fill their goatskin bags or sacks with fresh water as it bubbles from the springs at the bottom, and bring it to the surface without allowing the salt water to mix with it. The article further stated that no one knows how the natives learned of the supply, but that the water had been taken in that way probably for centuries. Now can and will you give me any light on this matter, as to the probability or improbability of the water supply coming from such a source and being secured in such a manner? A. There is nothing impossible nor improbable in the statement that fresh water is collected from springs which come up through the earth at the bottom of salt water. We personally know several places where pump logs have been put down into such springs and fresh water is pumped up through the salt water. The only improbable point in the story which you quote is in regard to the distance to which the men descend under water to secure the fresh water. Submarine divers have not gone below 200 feet from the surface with the advantage of armor, air supply and weights to sink them. The effort has been made to reach a wreck in 240 feet of water. The accounts state that at 130 feet the diver began to experience serious trouble. At 200 feet, after suffering terribly, he lost consciousness and was hauled up. Divers cannot work much below 100 feet. It is very improbable that men can be in the habit of descending 200 feet below the surface of the ocean.

(8297) W. H. asks: Could you inform me what is the best coating for the glass plates of static machines, whether shellac varnish or other varnish? I have been using bleached shellac varnish and it blisters and flakes off. A. Shellac varnish is the best coating. The glass must be perfectly clean and dry when the shellac is applied. A very slight trace of grease, such as a finger-mark, will prevent the adhesion of the varnish to the glass. Glass may be cleaned by washing it first in strong sodic hydrate (caustic soda), then in nitric acid, and last in distilled water. It is then allowed to dry. The surface should not be touched by anything, cloth or hands, after it leaves the acid. It will then be chemically clean. Before applying the shellac the glass should be warmed to render it perfectly dry. If these directions are followed there will be no trouble with the adhesion of the varnish.

(8298) D. G., Jr., asks how to temper steel dies in imitation of cloth or fine hair line, etc., so as to avoid the scale that appears on the surface of the die. A. Bright-faced dies that are to be kept free from scale in the hardening process should have their faces covered with a layer of hard soap and the die heated face up, which will keep the air from oxidizing the surface. Then it will come out of the hardening bath bright.

(8299) C. B. B. asks: Will you please tell me whether the dynamos described in SUPPLEMENTS 844 and 865 can be used to run electric furnace described in SUPPLEMENT 1182? A. The dynamo of SUPPLEMENT 865 will give current enough for a small electric furnace. A lower voltage is to be preferred, and a dynamo especially designed for such work would be very much better than one which was intended for lighting.

(8300) W. T. B. asks: I would like information in regard to the best manner of placing rods for the protection of buildings from lightning. A. The putting up of a lightning rod is a simple matter and requires very

little instruction; but if one has some knowledge of electrical matters, he can easily determine how a rod ought to be put up. The most important points to be attended to are tight joints and a good earth connection at the bottom of the rod. The parts of the rod should be screwed together with couplings, as in water and steam pipes. A small iron water pipe would make a good lightning rod; so would a flat strip of iron one inch wide and 1-16 inch thick. There is no need to go to the expense of a copper rod. Iron is by many considered really better than copper. The grounding of the rod must be attended to with great care. The lower end of the rod *must* be in water or in moist earth. A plate of iron or a coil of the rod itself should be connected to the end of the rod to insure good contact between the rod and the earth. Rods should be carried up at all the corners of the building, and go to the peaks of the gables and along the ridges of the roof, up chimneys, pinnacles and towers, to all the highest points of the building, but there should not be high rods above the roof and chimneys, such as are very often seen in the older practice of putting up lightning rods. Lightning rods are not put up to invite the lightning to come down that way, but to take care of it, if it insists upon coming. Rods should be fastened to the metal of roofs, gutters, and leaders, and should not be insulated from the house by glass insulators as was formerly the universal method. Such insulation is useless, since a quarter inch of glass cannot hold back a discharge which has already jumped through perhaps a mile of air. Short points may be put upon the rod at all the higher parts of the building, not more than a foot above the building, but these are not necessary. The idea that a tall rod protects a certain area around its base is no longer considered true. The rod if solid should not be more than a half inch thick. If it is a tube it may weigh about as much per foot as if it were solid. Heavy telegraph wire if put up plentifully would be as serviceable as a rod. A building well netted over with such wire, better galvanized for durability, would be as thoroughly protected as with the most expensive rod. Remember that surface of metal is what is wanted in a rod rather than weight. In many respects a heavy rod is inferior to a light one of greater surface. Continuity of the metal is the most important feature. There must be no air gaps, no loose joints. It will thus be seen that a blacksmith with a little gumption is just as well able to do the work of making and putting up a rod as the best engineer. Much valuable information upon this subject has been printed each year in these columns. You should also have SUPPLEMENTS, Nos. 249, 348, and 998, price ten cents each. We append the rules given by Prof. S. P. Thompson as a summary of the modern views upon this subject. It will be noted that our advice given above differs slightly in some unimportant particulars from these rules. 1. All parts of a lightning conductor should be of one and the same metal, avoiding joints as far as possible, and with as few sharp bends and corners as may be. 2. The use of copper for lightning rods is a needless extravagance. Iron is far better. Ribbon is slightly better than round rod; but ordinary galvanized iron telegraph wire is good enough. 3. The conductor should terminate not merely at the highest point of a building, but be carried to all high points. It is unwise to erect very tall pointed rods projecting several feet above the roof. 4. A good deep *wet* earth should be provided, independent of gas or water pipes, to which the conductor should be led down. 5. If in any part the conductor goes near a gas or water pipe it is better to connect them metallically than to leave them apart. 6. In ordinary buildings the conductor should be insulated away from the walls, so as to lessen liability of lateral discharge to metal stoves and things inside the house. 7. Connect all external metal work, zinc spouts, iron crest ornaments and the like, to each other and to the earth, but not to the lightning conductor. 8. The cheapest way of protecting an ordinary house is to run common galvanized iron telegraph wire up all the corners, along all the ridges and eaves, and over all the chimneys, taking them down to the earth in several places to a moist stratum, and at each place burying a load of coke. 9. Over the tops of tall chimneys it is well to place a loop or arch of the lightning conductor made of any stout and durable metal. Any man of intelligence can put up a lightning rod or wire from these simple rules, and may then feel assured that he has done all that can be done to protect his home from a stroke of lightning.

(8301) F. R. M. asks: 1. When light rays cross each other or reflect back upon themselves as they are made to do in diagrams of images formed by lenses and mirrors, why do they not become mixed up and produce interference? A. They do not become mixed up, but do interfere when the reflection is at a suitable angle. It is in this way that the fact that light is due to a wave motion was demonstrated by Fresnel. These interferences cannot be seen in the open, but require a dark room and special arrangements. They can be seen by placing the hand over the eye so that you can look at a bright light, such as an open window will furnish in a clear day. You will then see innumerable dark lines in the space between two fingers, parallel to the fingers. These are interference lines. The waves do not become mixed up, because any number of sets of waves can pass at once through the same space as if no other wave were there. This is the case with water waves on a lake or the ocean. It is the case with sound waves. Two persons can talk at the same time in the same room and be heard by others. A whole orchestra can play at the same time and no jumble or mixture of the sound result. Perfect harmony will result. We see no reason why light waves which are not vibrations of ordinary matter, as these other vibrations are, should be mixed or confused by existing in the same space together. 2. When two moving shadows approach each other, why do they rush together just before they meet? A. We would try to explain this if we thought the question stated a fact. We do not think two shadows move any faster as they come near each other than they did when further apart. 3. Is it a fact that food will sour more quickly if put into a refrigerator while still quite warm? If so, please explain. A. We do not think so. The reason a hot dish should not be put into a refrigerator is that it heats the air and destroys the work the ice has already done. In the hot refrigerator food will then spoil. This is because the air of the refrigerator has been heated, and not because hot food was put in. 4. Why is it that milk sours in a thunderstorm? A. We do not know.

(8302) C. W. R. asks: Will you please refer me to some book describing fully transformers made to transform a two-phase to a three-phase current or *vice versa*? A. We presume you wish to find the plans from which you can make the transformer you require. We do not know any published plans of this sort. There are good books upon the theory of the transformer. Such is Kapp's, price $1.75 by mail; Adams's "Transformer Design," price $1.50 by mail. By the aid of these you might work out what you need.

(8303) F. W. writes: I have a small motor which runs a fair speed when using 4 volts and ¼ ampere. I would like to run the motor on a 110-volt light circuit. What size wire must I use on the field and armature? A. There is probably not room for the wire to rewind the motor for 110 volts. The better way is to put the motor in series with two 16-candle lamps. It will then get ¼ ampere and a few volts.

(8304) G. O. S. writes: During a thunder shower here it was said that some of the stitchers using sewing machines run by an electric motor connected to the shafting by a 10 or 15 foot leather belt experienced a sensation like that of one's feet going to sleep. Is it possible that they felt a slight shock? It is not dangerous to run the motor during a thunder shower, is it? The power is furnished by the Edison Company. A. Anything is possible with the lightning, but it is not apparent from your description that anything happened. The sensation may have been from electricity, and again it may have been from nervousness, No one can tell. A quiet mind would eliminate one cause of unpleasant sensation at such a time. No electric disturbance is likely to have passed from the Edison wires through a leather belt to the sewing machine. If the Edison wires are underground they are not likely to receive a lightning discharge. Aerial wires are very often struck by lightning, but when suitable lightning arresters are used there is little likelihood of the electricity of the lightning entering a building. If your installation is properly made there should not be any special risk at the sewing machines during a thunderstorm.

(8305) W. S. P. asks: 1. What are the modern works upon the telephone? I don't mean the working of an individual telephone, but the methods for connecting and working them. A. The best work upon this subject is Miller's "American Telephone Practice," price $3 by mail. It is very full and complete. Another important work is Hopkins's "Telephone Lines and Their Properties," price $1.50 by mail. With these two you have a very complete presentation of the whole subject. Of smaller books there are Webb's "Telephone Handbook," price $1, and Poole's "Practical Telephone Handbook," price $1.50 by mail. 2. What are the strengths of the several currents used in telephone work, say inside of New York city? (Not long-distance.) What strength suffices for ordinary speaking current? A. The current strength, of course, varies with the different transmitters. It is very minute with all. Prof. Cross, of Boston, by employing very delicate instruments and great refinement of method, reached the following results: The current in the secondary wire of the induction coil of the Edison transmitter, 0.072 milliampere; of the Blake transmitter, 0.132 milliampere; of the Hunnings transmitter, 0.556 milliampere. 3. What for the magneto-electric that rings the local call bell? A. Magneto call bells are wound to 300 to 500 ohms for local work; for bridged work much higher, to 10,000 ohms even. The E. M. F. of the magneto when run as ordinarily by hand is from 65 to 75 volts. As the current is alternating, the amperes are less than the quotient of the volts by the ohms; but at any rate the current strength is very small. We have no exact data upon the point.

(8306) L. A. F. asks: Is there an escape or loss of electric fluid if the electric light bulb or lamp is removed from its holder when the current is on? Will the meter register it? A. If a socket is in good condition there ought not to be any leakage when the lamp is removed. If, however, there is leakage the meter will register the current which is lost.

(8307) J. M. asks: 1. If a stone is dropped into the ocean at a very deep part, will the stone sink to the bottom or will it remain above the bottom and float in the water? I heard some people say that the pressure was so great that the stone could not sink. A. Anything which begins to sink in the water of the ocean will continue to sink till it reaches the bottom underneath it. The pressure is very great. At 24,000 feet it is four tons per square inch, and at the greatest depths of the ocean it is about five tons per square inch. This will compress any article which sinks to that depth very greatly and render it much heavier relatively to the water; but the water is not compressed to any degree by even that great pressure. So that the article which is sinking and being compressed is all the time growing heavier relatively to the water and will sink faster the farther it sinks. 2. Has a cannon on board of a man-of-war a device to make it rebound, or is the cannon fastened to the ship? A. The old method was to allow the gun to run back by its recoil so as to load it again. All modern guns are breechloaders and do not run back by their recoil. The force of the recoil is taken up by a liquid pressure, some liquid such as glycerine being used.

(8308) Farmer asks: Will you kindly tell me through your paper whether lightning rods secured to buildings with malleable iron brackets are a protection against lightning? It would appear to me that the rods should be insulated at all points where they come in contact or are secured to the building or they must be more dangerous than otherwise. A. Opinions differ upon this point. Equally good authorities are to be found upon both sides of the question. We are personally inclined to the opinion that a lightning rod may just as well be connected to the house directly as to use a glass insulator. Our reasons for this opinion are that the glass will be wet as soon as rain falls and its insulating value will be greatly reduced; and the electric discharge, which has already leaped through thousands of feet of air between the cloud and the earth, will not mind the few inches of air through which it must pass in going from the rod to the iron support of the rod around the insulator.

(8309) A. S. asks: How many units of heat for a stated weight of the metals sodium and potassium are evolved in passing to the condition of KOH and NaOH respectively? A. When one gramme of potassium combines with oxygen there are 1,745 units of heat produced. When one gramme of sodium combines with oxygen 3,293 units of heat are produced. We have no separate data for the change from the oxide to the hydrate.

(8310) J. C. M. writes: I have a son 15 years old who wants to learn all about electricity and electric instruments. You no doubt have such books on sale. I would like to have catalogues of them, with your recommendation of such as you think most suitable for him. He wants a *descriptive* and *practical* work—one that will give him complete instructions for making and repairing any *part* of any *kind* of electric or magnetic appliance. A. There is no work or set of books which can supply what is asked in this request. We presume the intention is to ask for books by means of which the lad can make a beginning of learning electricity. We can furnish Sloane's "Electrical Library" for $5 by mail. There are also separate books to be had upon making telephones, putting in electrical bells, etc. After these might come the building of a small dynamo or motor, the making of a galvanometer and induction coil. These can be found in Bottone's "Electrical Instrument Making for Amateurs," price 50 cents.

(8311) W. I. P. asks: Where can I get information on the subject of wave motion and the attempts to use it as a power? A. See SUPPLEMENTS, Nos. 536, 825, 861, price ten cents each, for articles describing various devices which have been employed to utilize the force of waves to do work.

(8312) H. R. asks: As to the electric motor described in "Experimental Science." Do you sell it or its parts? A. We do not sell any of the apparatus described in "Experimental Science" or the parts of any of it. The object of the book is to stimulate ingenious persons to "make things" by showing them how to proceed. This object it is accomplishing. There is no book so well adapted to help one to build suitable and sufficient apparatus for studying science within its limits as is this book.

(8313) F. R. asks: What book or paper gives information on the Marconi wireless telegraphy. I wish a description of instruments and operation of same. Can such instruments be made in an ordinary machine or model making shop. A. Fahie's "History of Wireless Telegraphy," price $2 by mail, gives descriptions of the various systems which have been invented, Marconi's among the rest. We have published several papers on the subject, but none which gives details of construction such as would enable a man to build a copy of the apparatus. Moreover, Mr. Marconi is changing his apparatus continually as the results of his experiments, and no description is up-to-date upon the subject. There is nothing about the apparatus which could not be built in any ordinary shop.

TO INVENTORS.

An experience of over fifty years, and the preparation of more than one hundred thousand applications for patents, at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office Scientific American, 361 Broadway, New York.

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July 30, 1901,

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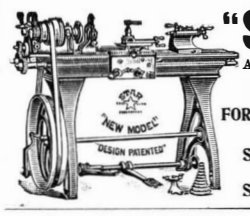

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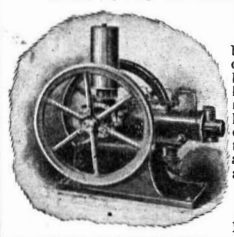

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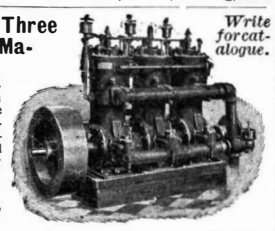

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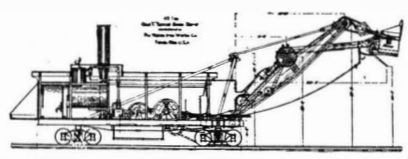

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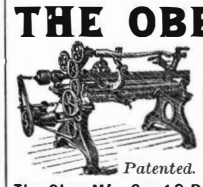

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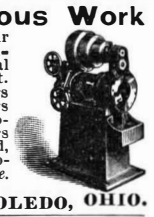

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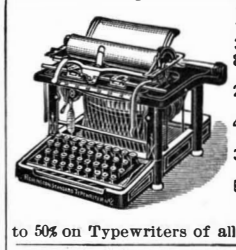

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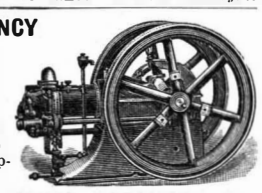

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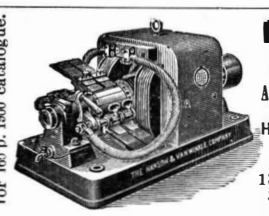

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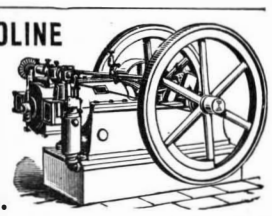

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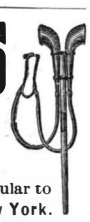

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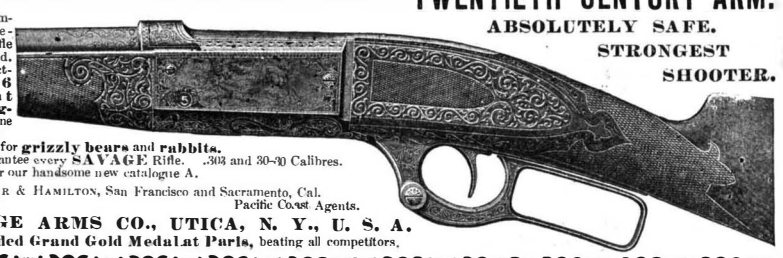

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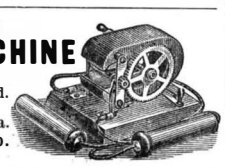

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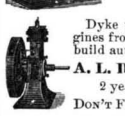

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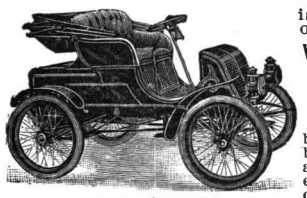

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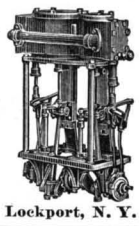

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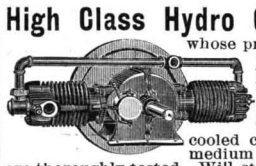

whose production is the result of science, skill, patience, time and money, are manufactured in two sizes, 4 and 5 h. p., and are of the balance type with opposite end air-cooled cylinders. For light and medium weight runabouts and are thoroughly tested. Will start at any time, it makes no difference how cold or warm the weather is. Air and water cooled cylinder. Interchangeable in half hour. Bearings made of best Phosphor Bronze. Length 28 ins.
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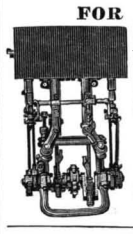

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Power is the life of the vehicle. We have perfect power.

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One 10 H. P. Mietz & Weiss Kerosene Engine.

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Better than Red Lead

For making joints in gas pipes, steam pipes, water pipes, compressed air pipes, and putting around gaskets and flanges, caps, headers, bolts and nuts, nothing excels

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Joints can be easily taken apart after years of use even when the pipes are rusted. Manufacturers, machinists, engineers, contractors and gas companies freely use and endorse it. Booklet free.

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Criterion Stereopticons. Acetylene Search Lights.

BY J. E. CONANT & CO., Auctioneers
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ABSOLUTE AUCTION SALE

the completely equipped plants, together with the tenement property, of the

PROSPECT WORSTED MILLS,
AND OF THE
GLOBE WORSTED MILLS,

(widely and favorably known for the manufacture of worsted yarns)

LAWRENCE, MASSACHUSETTS.

The plants, which are located in different sections of the City, are to be sold in two separate parcels; the sale to take place upon the respective premises regardless of any condition of the weather; to be without limit or reserve to the highest bona fide bidders; to begin promptly at half-past two o'clock in the afternoon with the Prospect Mills, following at 3:45 o'clock with the Globe Mills, and finishing at 4:15 o'clock with the tenement property adjacent to the Globe Mills, Thursday, the 22d day of August, 1901.

PROSPECT WORSTED MILLS.
(South Side of City.)

The business was originated by Butler & Robinson in 1863. In 1879 was moved to south canal of Essex Company or the plant we now offer. The business, incorporated in 1892, and capitalized for $150,000, as Prospect Worsted Mills, has proved very successful. The property is in best worsted labor district in America, on south bank Merrimack river; has perfect railroad facilities; perpetual right to the use of 150 h. p. from the canal at fixed charge of $3,000 per year; also ample chance to get all added power required at very reasonable rates. Land has frontage of 200 ft. on river, 200 ft. on railroad and street, is 250 ft. deep. Buildings—brick buildings; main mill 58x124 ft., 4 stories and gravel roof; 1 story ell, 36x130 ft.; 1 story ell, 27x60 ft.; office building, 26x32 ft., 1½ stories, with basement; ells, 14x20 ft. and 10x11½ ft. Wooden buildings—Sorting room, 27x111 ft; three storehouses, 26x66, 18x17 and 25x40 ft.; stable, 22x32 ft.; engine house, 13x76 ft.; power elevator tower, 10x10 ft.; sheds, &c. Capacity 8,000 lbs. 2 ply 40's worsted yarn per week. Power from canal. Auxiliary steam plant; Green improved 75 h. p. Providence Engine Co. engine; two 75 h. p. boilers, &c. The plant is a going concern, and the reputation of its product is first-class. A recent appraisal by reliable experts is $123,850. It has got to be sold. Endorsements for another corporation the cause. Former owners not bidders.

GLOBE WORSTED MILLS.
(North Side of City.)

This plant was incorporated in 1880 with a capital of $30,000, about 1892 it was raised to $90,000; the property is on the Spicket river. Capacity of plant is upwards of 5,000 lbs. of 2 ply 32's or 36's worsted yarn per week. It owns its own water power, dam and canal. The real estate and machinery are good; the equipment is complete; the premises are electrically lighted; spinning and twisting rooms are supplied with Drosophore System; new 27-inch Horizontal McCormick Improved Wheel added within a year; dam has been reconstructed and raised in same time; steam plant consists of a 75 h. p. Green's Improved Providence Co. Engine, two 75 h. p. boilers, etc. The land runs about 740 ft. along river front, about 219 ft. on Allen street, total area 75,000 sq. ft. Buildings—brick buildings; mill, 40x176 ft., 2 stories, gravel roof, with exception of westerly end, which is 2½ stories with basement, and slated roof; 1 story ell, 28x39 ft.; 1 story wing, 13x13 ft. Wooden buildings—Engine house, 12x40 ft.; office building, 13x36 ft., 1½ stories; 1 story storing and sorting room, 34x40 ft.; 2 story machine shop and scouring room, 34x50 ft.; 1 story drying room, 1250 sq. ft. floor area; stable, 17x33 ft. Water power. The appraisal of this plant by experts was $57,747. Like the Prospect mills it is to be sold absolutely without limit or reserve to the highest bidder.

The purchaser of the Prospect Worsted Mills must deposit with or secure to the Auctioneers $10,000, as soon as property is struck off.

The purchaser of the Globe Worsted Mills must deposit with or secure to the Auctioneers $5,000 as soon as the property is struck off.

The Trustees have arranged that 50% of the purchase money, on either plant, may remain on mortgage for a term of one year, with interest at the rate not to exceed 4½% per annum. The deeds to be taken in thirty days and purchasers to pay the taxes for the current year. All inquiries by mail, telephone or otherwise must be made at the office of the Auctioneers, where you should send for an illustrated catalogue of the property.

HENRY K. WEBSTER, CHARLES W. WALWORTH, WM. S. KNOX,
Trustees in Bankruptcy

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